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(54) IP-ENHANCED CELLULAR SERVICES

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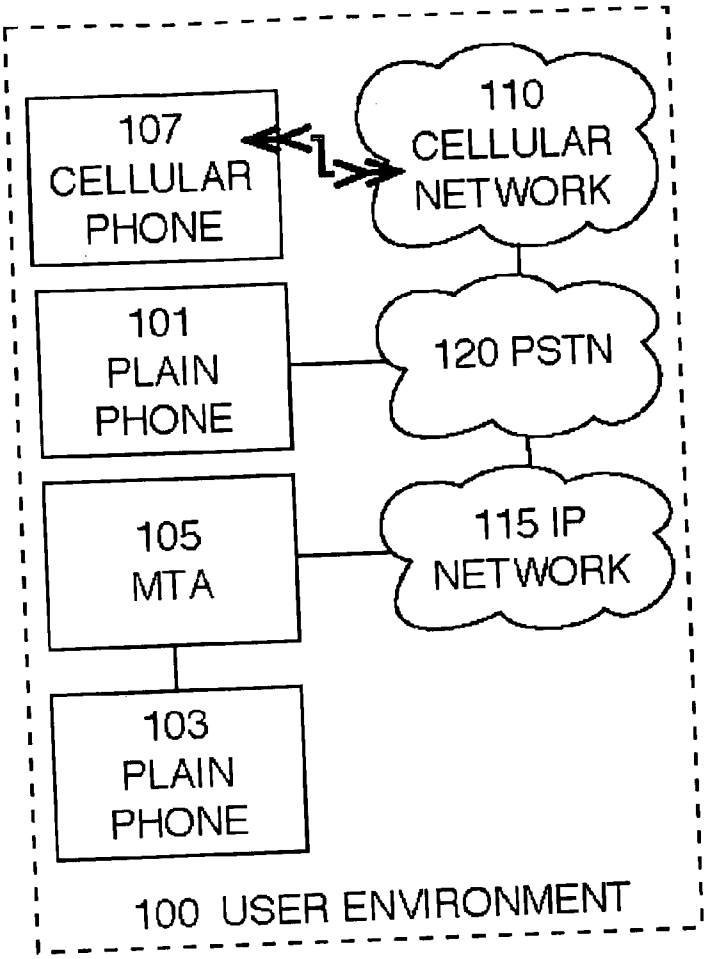
(57) **ABSTRACT**

A federation of multinational PSTN, IP and cellular service providers coordinate their accounting by: populating a subscriber database of subscribers to one number services, a service providers database and a payments clearing database having amounts owed across the service providers based on the individual service provider's portion of pre-agreed payments for services; collecting accounting data from the service providers; updating the relevant databases with the data collected; and providing accounting data to the service providers and subscribers. Voice over IP service is applied to a cellular phone by selecting a compatible codec at peripheral gateways of IP network paths, thereby avoiding transcoding by a connecting multimedia terminal adapter. A portable module, multimedia terminal adapter cellular internet protocol gateway for media communications over an IP network (MTAC IPG) bridges a cellular network, an IP network and a PSTN so that a user may locally dial a cellular phone that is then used to enter the IP network and dial the called party. The MTAC IPG provides gateway functionality and packetizing.



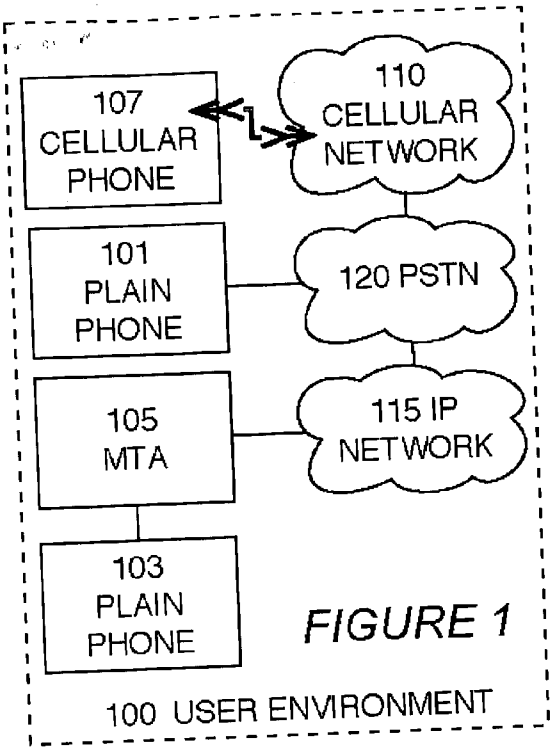


FIGURE 1

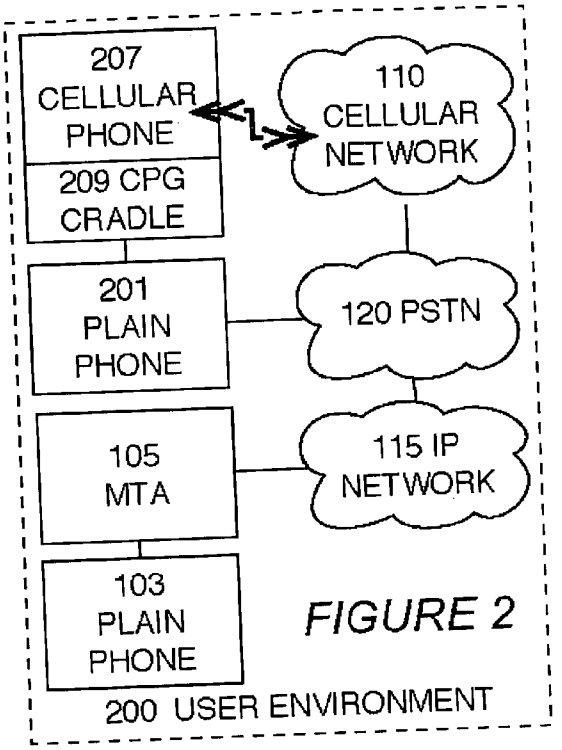


FIGURE 2

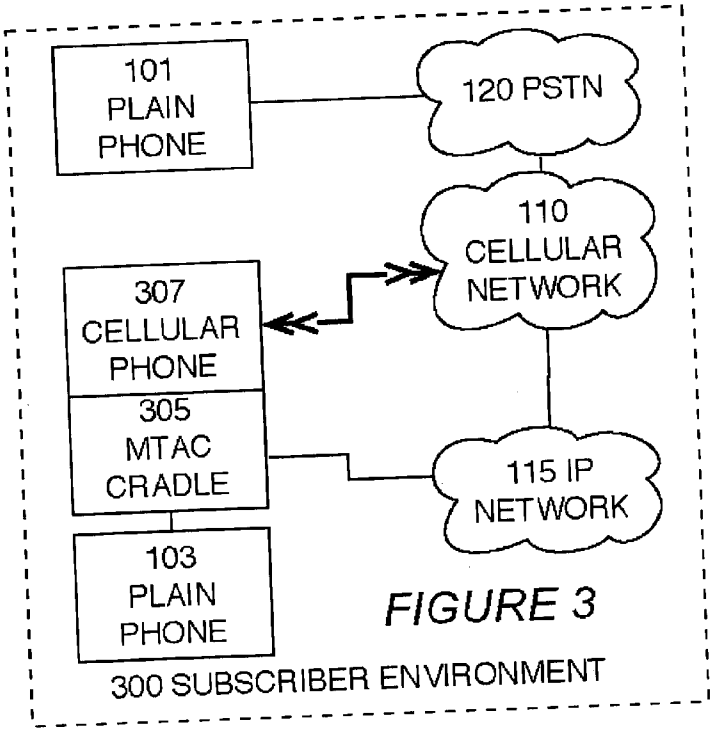


FIGURE 3

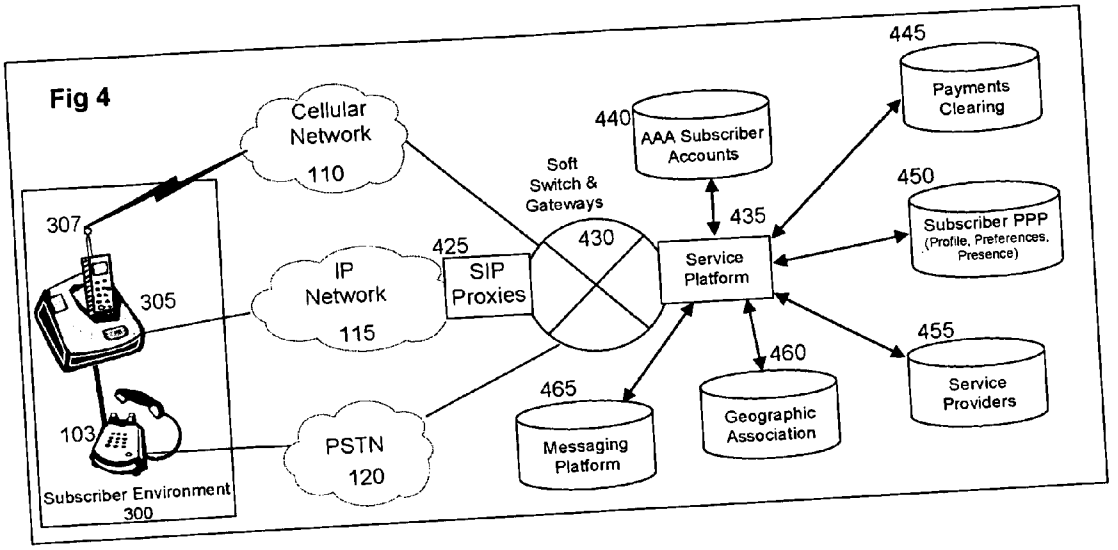


Fig 4
Cellular Network 110
IP Network 115
PSTN 120
307
305
103
Subscriber Environment 300
425
SIP Proxies
Soft Switch & Gateways
430
440
AAA Subscriber Accounts
435
Service Platform
445
Payments Clearing
450
Subscriber PPP (Profile, Preferences, Presence)
455
Service Providers
460
Geographic Association
465
Messaging Platform

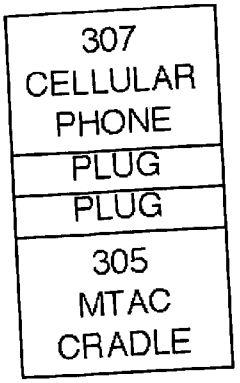


FIGURE 5A

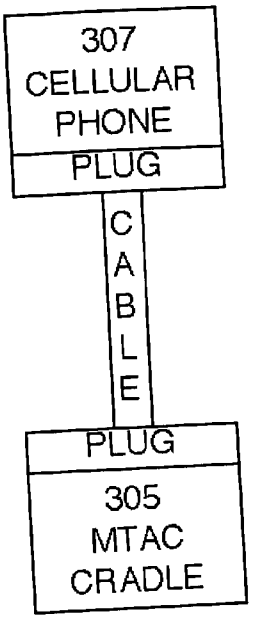


FIGURE 5B

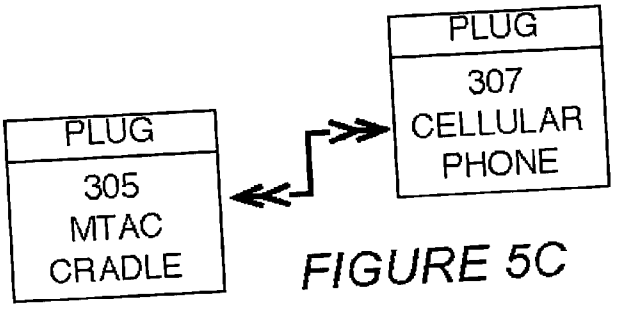


FIGURE 5C

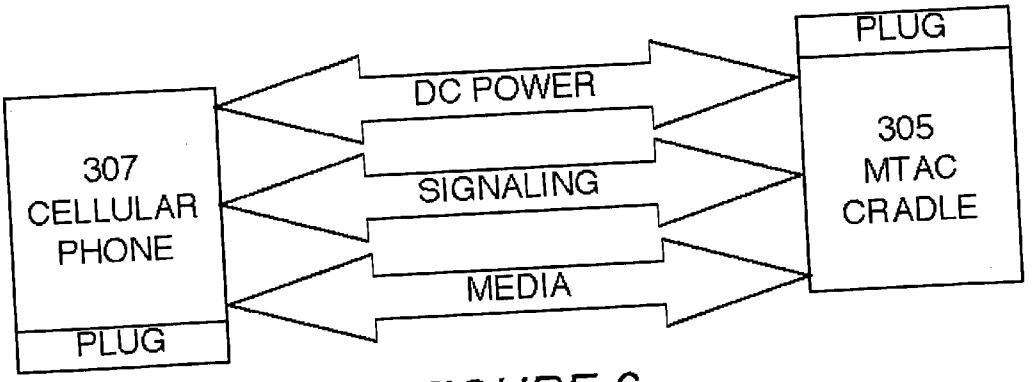


FIGURE 6

Fig 7

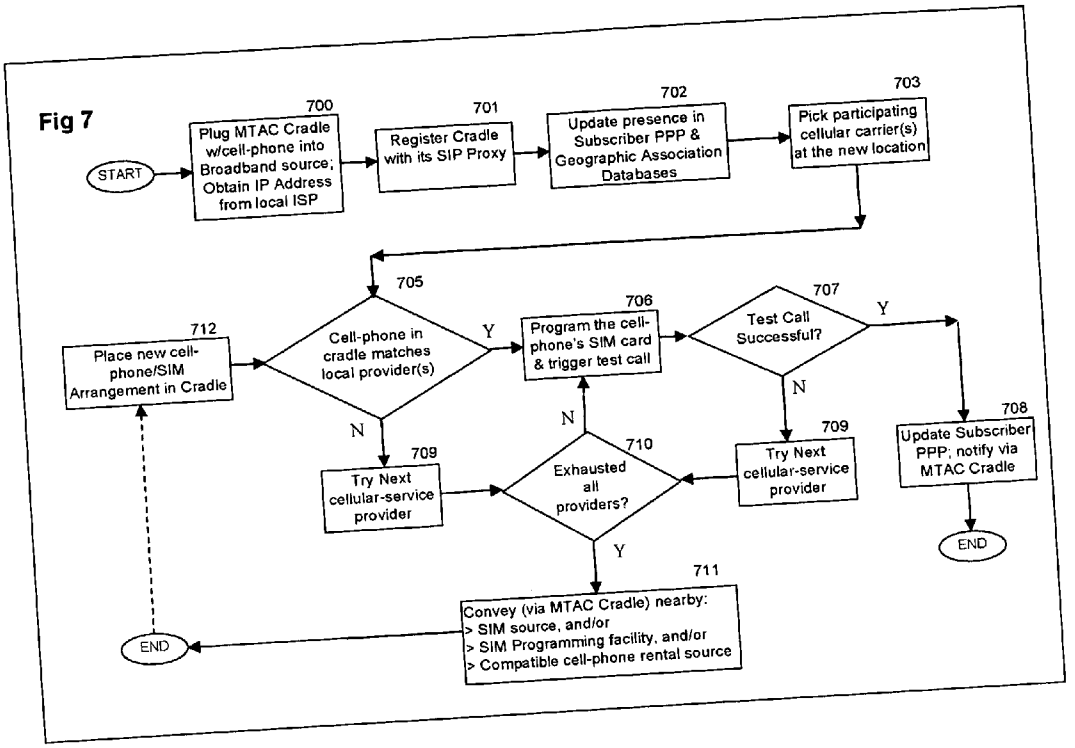

START
700
Plug MTAC Cradle w/cell-phone into Broadband source; Obtain IP Address from local ISP
701
Register Cradle with its SIP Proxy
702
Update presence in Subscriber PPP & Geographic Association Databases
703
Pick participating cellular carrier(s) at the new location
705
Cell-phone in cradle matches local provider(s)
Y
N
706
Program the cell-phone's SIM card & trigger test call
707
Test Call Successful?
Y
N
708
Update Subscriber PPP; notify via MTAC Cradle
END
709
Try Next cellular-service provider
710
Exhausted all providers?
N
Y
711
Convey (via MTAC Cradle) nearby:
> SIM source, and/or
> SIM Programming facility, and/or
> Compatible cell-phone rental source
712
Place new cell-phone/SIM Arrangement in Cradle
END

FIGURE 8

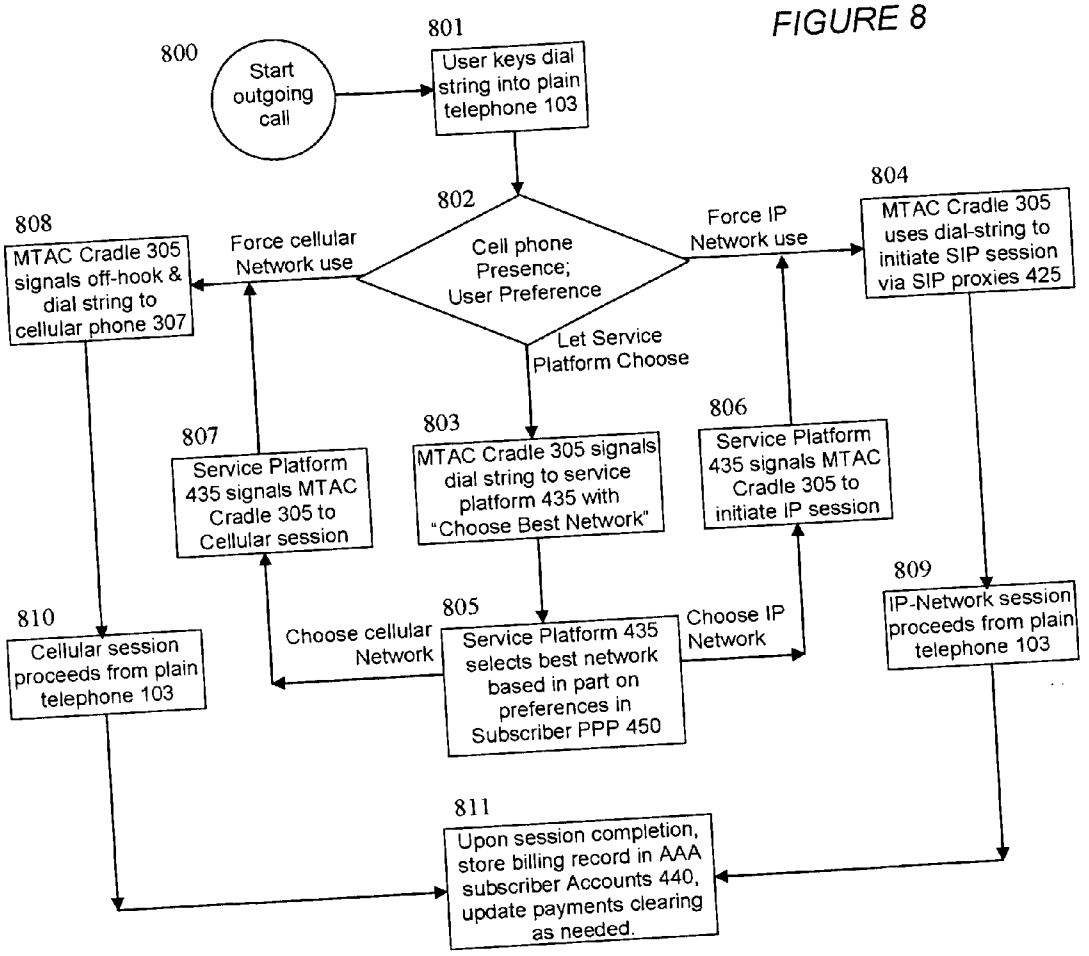

800
Start outgoing call
801
User keys dial string into plain telephone 103
802
Cell phone Presence; User Preference
Force cellular Network use
Force IP Network use
Let Service Platform Choose
804
MTAC Cradle 305 uses dial-string to initiate SIP session via SIP proxies 425
808
MTAC Cradle 305 signals off-hook & dial string to cellular phone 307
807
Service Platform 435 signals MTAC Cradle 305 to Cellular session
803
MTAC Cradle 305 signals dial string to service platform 435 with "Choose Best Network"
806
Service Platform 435 signals MTAC Cradle 305 to initiate IP session
809
IP-Network session proceeds from plain telephone 103
810
Cellular session proceeds from plain telephone 103
Choose cellular Network
805
Service Platform 435 selects best network based in part on preferences in Subscriber PPP 450
Choose IP Network
811
Upon session completion, store billing record in AAA subscriber Accounts 440, update payments clearing as needed.

Fig 9

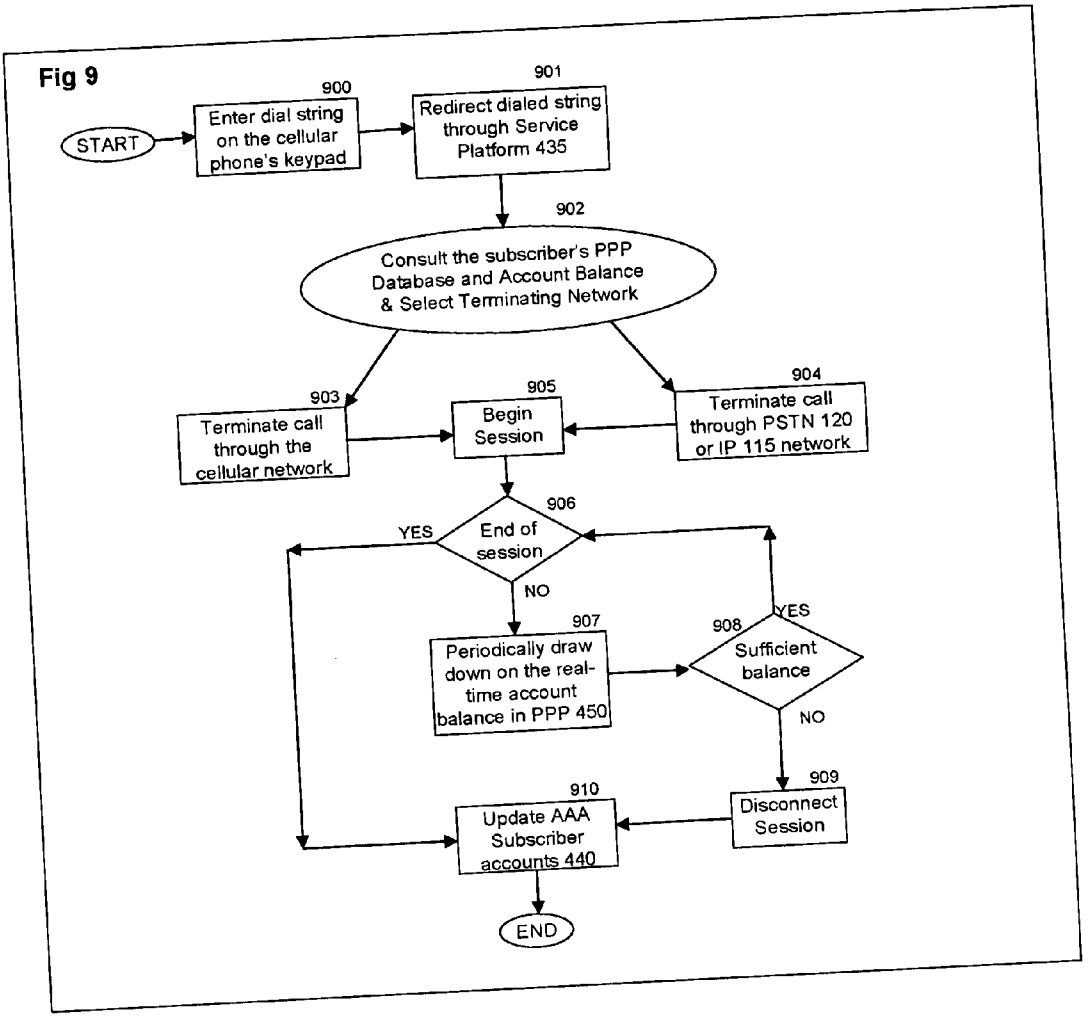

START
900
Enter dial string on the cellular phone's keypad
901
Redirect dialed string through Service Platform 435
902
Consult the subscriber's PPP Database and Account Balance & Select Terminating Network
903
Terminate call through the cellular network
905
Begin Session
904
Terminate call through PSTN 120 or IP 115 network
906
End of session
YES
NO
907
Periodically draw down on the real-time account balance in PPP 450
908
Sufficient balance
YES
NO
909
Disconnect Session
910
Update AAA Subscriber accounts 440
END

Fig 10

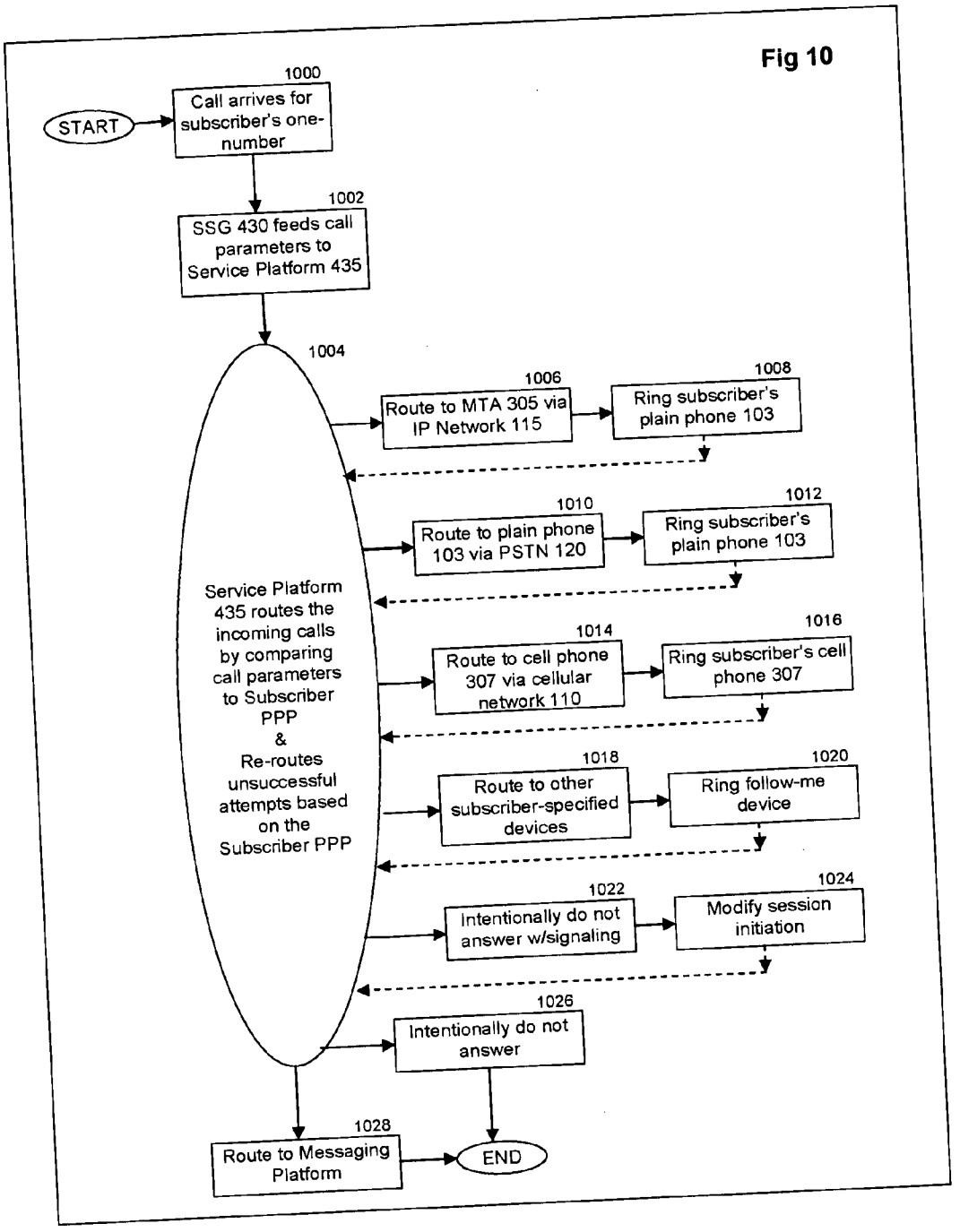
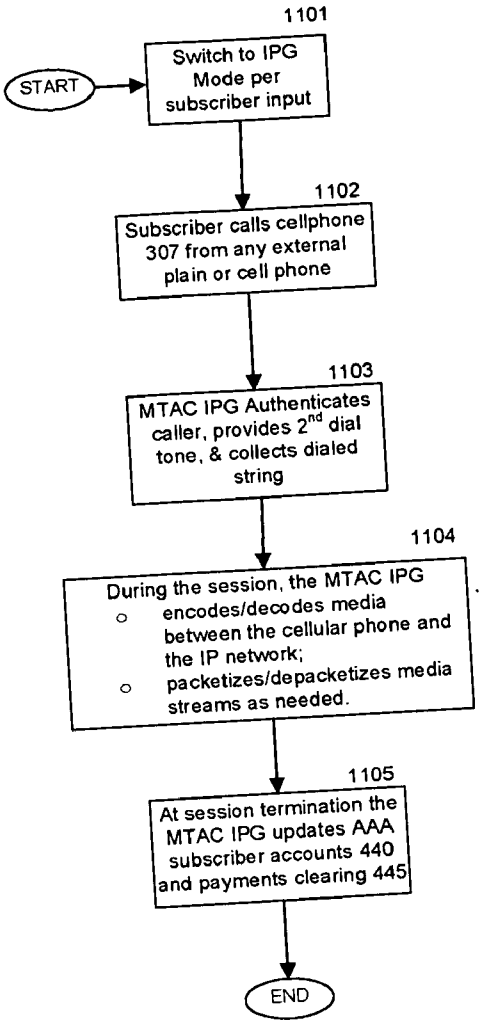

START
1000
Call arrives for subscriber's one-number
1002
SSG 430 feeds call parameters to Service Platform 435
1004
Service Platform 435 routes the incoming calls by comparing call parameters to Subscriber PPP
&
Re-routes unsuccessful attempts based on the Subscriber PPP
1006
Route to MTA 305 via IP Network 115
1008
Ring subscriber's plain phone 103
1010
Route to plain phone 103 via PSTN 120
1012
Ring subscriber's plain phone 103
1014
Route to cell phone 307 via cellular network 110
1016
Ring subscriber's cell phone 307
1018
Route to other subscriber-specified devices
1020
Ring follow-me device
1022
Intentionally do not answer w/signaling
1024
Modify session initiation
1026
Intentionally do not answer
1028
Route to Messaging Platform
END

Fig 11


START
1101
Switch to IPG Mode per subscriber input
1102
Subscriber calls cellphone 307 from any external plain or cell phone
1103
MTAC IPG Authenticates caller, provides 2nd dial tone, & collects dialed string
1104
During the session, the MTAC IPG
encodes/decodes media between the cellular phone and the IP network;
packetizes/depacketizes media streams as needed.
1105
At session termination the MTAC IPG updates AAA subscriber accounts 440 and payments clearing 445
END

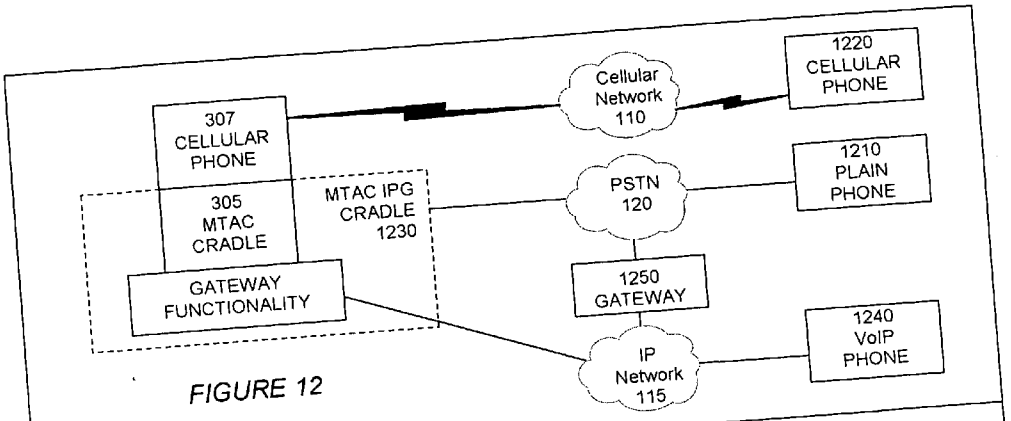


FIGURE 12

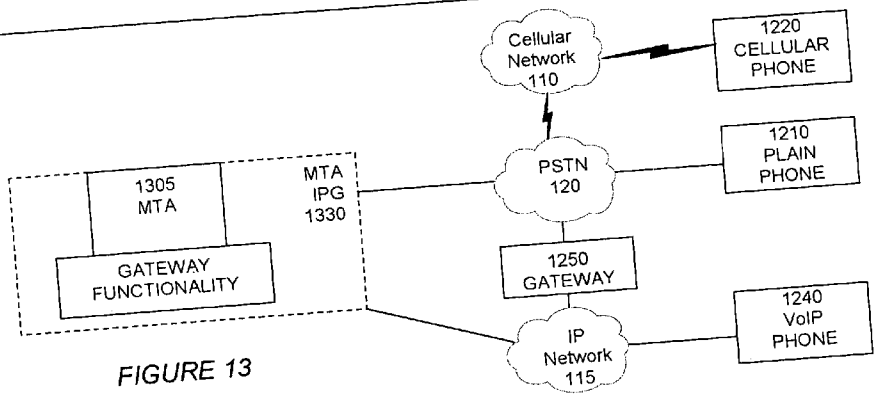


FIGURE 13

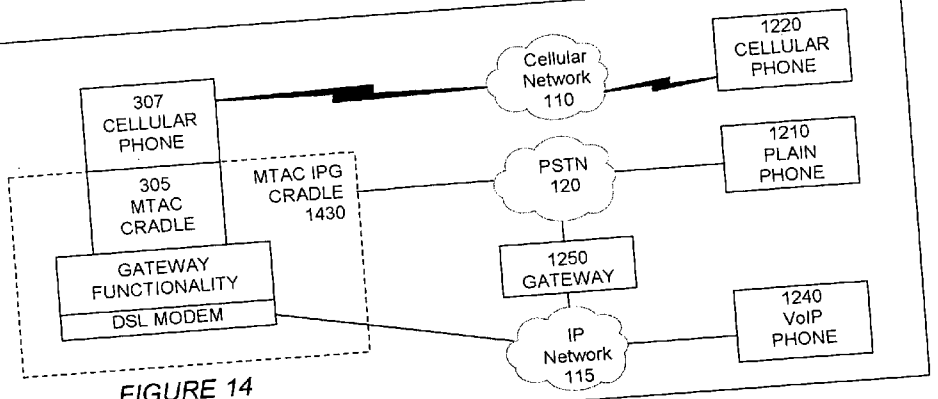
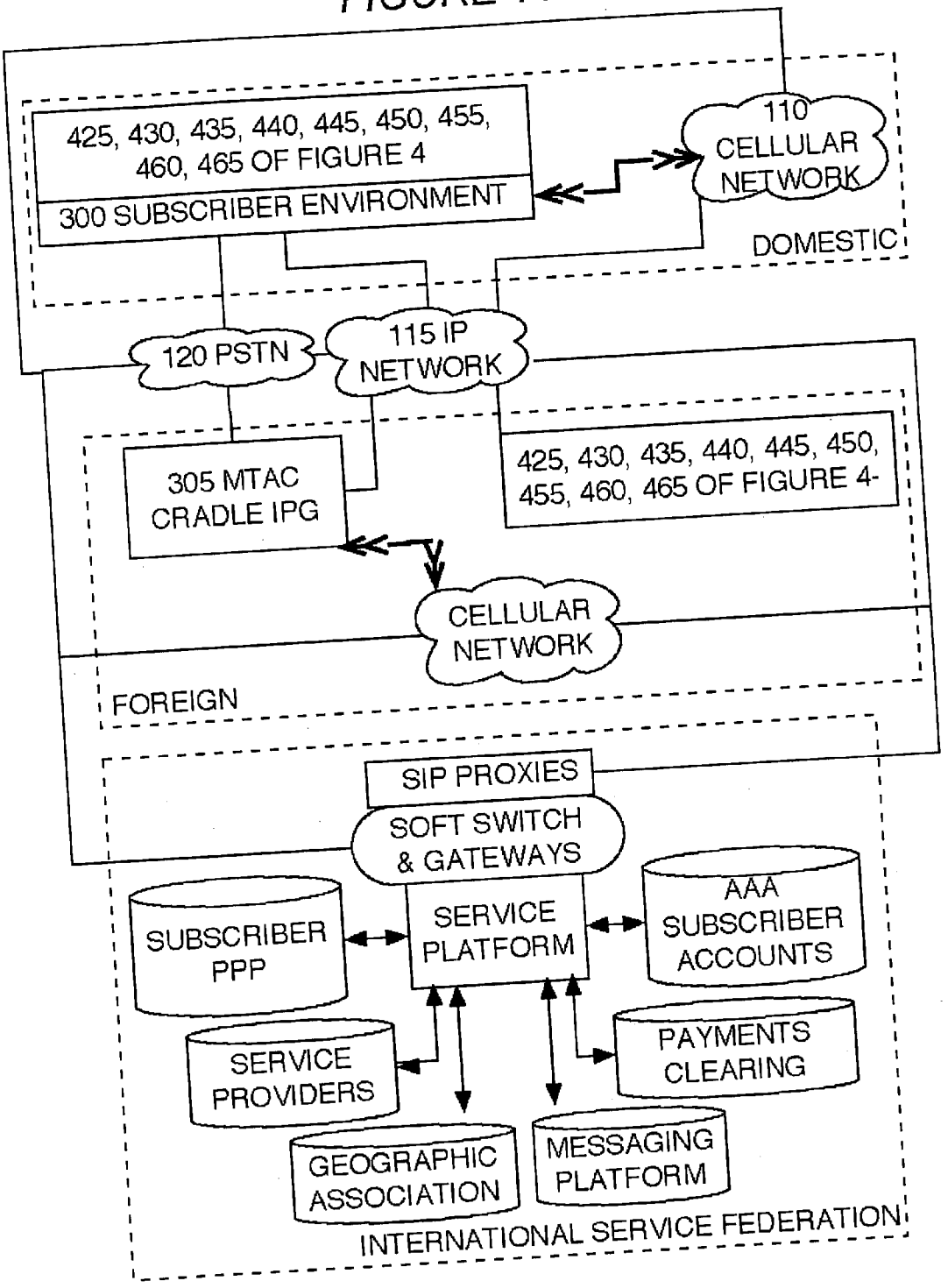


FIGURE 14

FIGURE 15


425, 430, 435, 440, 445, 450, 455, 460, 465 OF FIGURE 4
300 SUBSCRIBER ENVIRONMENT
110 CELLULAR NETWORK
DOMESTIC
120 PSTN
115 IP NETWORK
305 MTAC CRADLE IPG
425, 430, 435, 440, 445, 450, 455, 460, 465 OF FIGURE 4-
CELLULAR NETWORK
FOREIGN
SIP PROXIES
SOFT SWITCH & GATEWAYS
SUBSCRIBER PPP
SERVICE PLATFORM
AAA SUBSCRIBER ACCOUNTS
SERVICE PROVIDERS
PAYMENTS CLEARING
GEOGRAPHIC ASSOCIATION
MESSAGING PLATFORM
INTERNATIONAL SERVICE FEDERATION

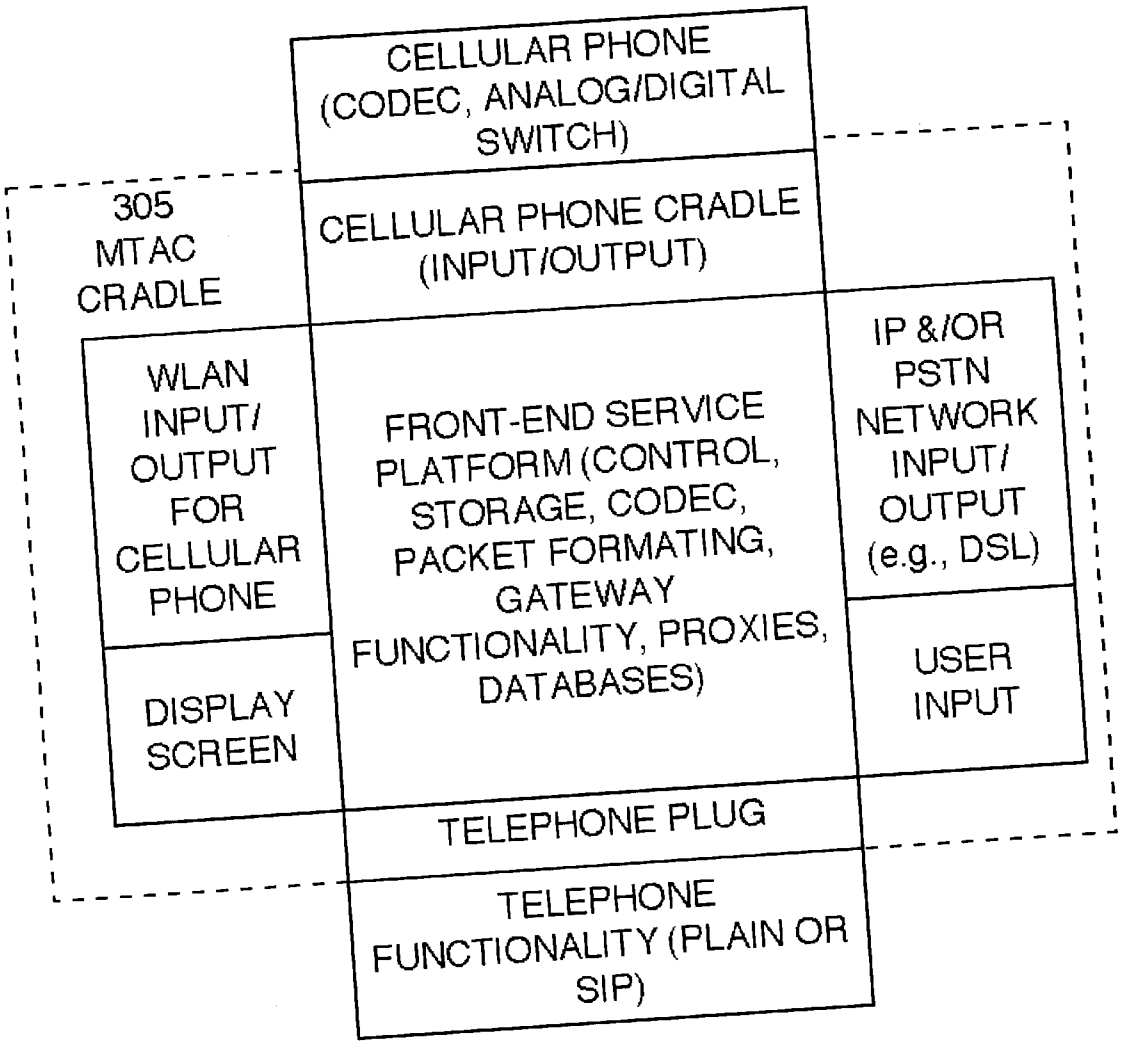
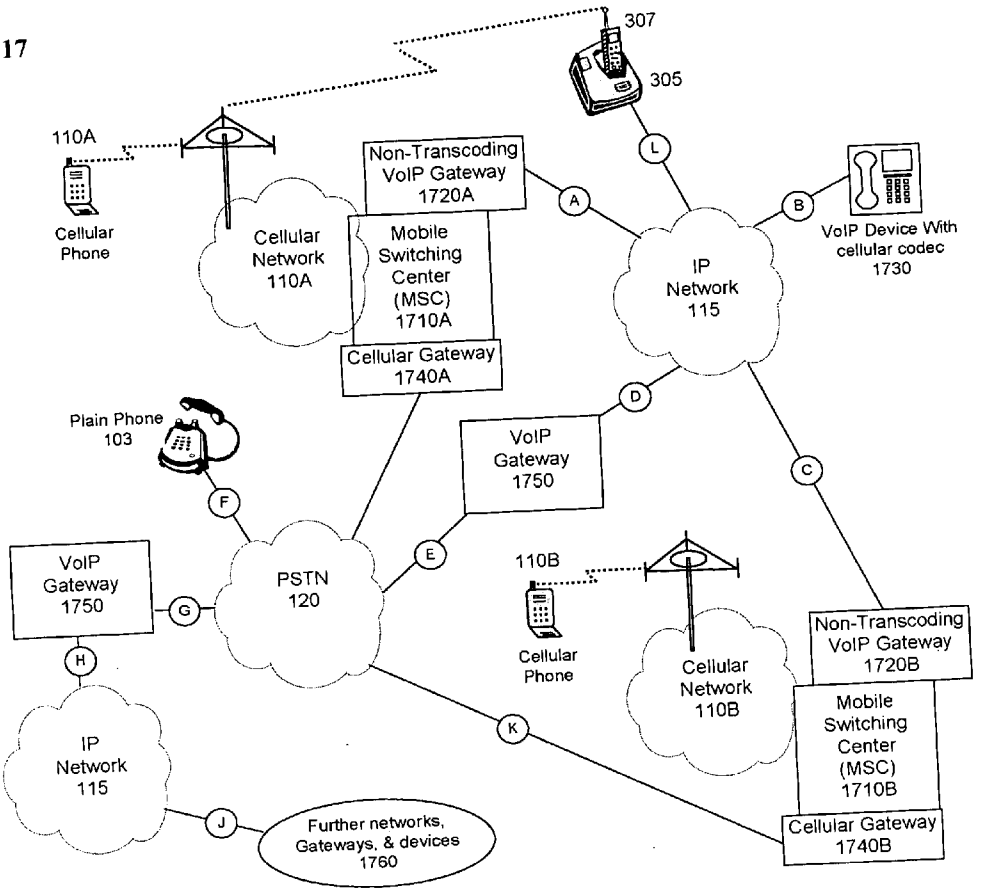

CELLULAR PHONE (CODEC, ANALOG/DIGITAL SWITCH)
305 MTAC CRADLE
CELLULAR PHONE CRADLE (INPUT/OUTPUT)
WLAN INPUT/ OUTPUT FOR CELLULAR PHONE
FRONT-END SERVICE PLATFORM (CONTROL, STORAGE, CODEC, PACKET FORMATING, GATEWAY FUNCTIONALITY, PROXIES, DATABASES)
IP &/OR PSTN NETWORK INPUT/ OUTPUT (e.g., DSL)
DISPLAY SCREEN
USER INPUT
TELEPHONE PLUG
TELEPHONE FUNCTIONALITY (PLAIN OR SIP)

FIGURE 16

Fig 17


307
305
110A
Cellular Phone
Non-Transcoding VoIP Gateway 1720A
Cellular Network 110A
Mobile Switching Center (MSC) 1710A
Cellular Gateway 1740A
A
L
B
VoIP Device With cellular codec 1730
IP Network 115
D
Plain Phone 103
F
VoIP Gateway 1750
C
VoIP Gateway 1750
G
PSTN 120
E
110B
Cellular Phone
Cellular Network 110B
Non-Transcoding VoIP Gateway 1720B
Mobile Switching Center (MSC) 1710B
H
K
IP Network 115
J
Further networks, Gateways, & devices 1760
Cellular Gateway 1740B

IP-ENHANCED CELLULAR SERVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is related to co-pending applications entitled "MTA-CRADLE PERSONAL GATEWAY" and "IP-ENHANCED CELLULAR SERVICES," U.S. application Ser. No. _____ (Attorney Docket No. 2655-0009) and U.S. application Ser. No. _____ (Attorney Docket No. 2655-0010), respectively, filed on even date herewith. The contents of those applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The invention relates to the use of a MTA (Multimedia Terminal Adapter), phones and cellular communication devices for establishing and conducting call sessions over Public Switched Telephone Networks (PSTN), cellular networks, and packet (e.g., IP) networks.

[0004] 2. Description of the Related Art

[0005] Prior to the present invention, the interrelationship between Voice over Internet Protocol (VoIP) and Cellular telephony was contextualized around voice over Wireless Local Area Network (WLAN) and dual-mode devices (devices that communicate through cellular and WLAN networks). Related technology centered on one-number (including follow-me) services in which VoIP service providers (e.g., AT&T CallVantage, Vonage, etc.) permitted their customers to set up one-directional call redirection (from IP to cellular) based on specific customer-set preferences. Cellular-to-IP redirection is not a common part of one-number or follow-me arrangements. The one-number service is important because it tends to add "stickiness" to telecommunications services. Stickiness in this context refers to a customer's reluctance to drop the subscription to a particular service. For example, maintaining the association with a phone number (that is well known by business associates, friends, and family) is a "sticky" feature.

[0006] International travelers who value mobility may rent cellular phones abroad, and may further reduce the cost of international calls by supplementing the cellular phones with calling cards. A traveler who subscribes to VoIP services and obtains an MTA (Multimedia Terminal Adapter), may under certain circumstances carry the MTA to remote international locations, and plug the MTA into a broadband-network outlet, thus enabling inexpensive communications to or from the remote country by using VoIP. The MTA has the additional advantage of enabling the subscriber to be associated with a single phone number regardless of the subscriber's location. However, the traveling subscriber must have access to the broadband-plugged MTA to make or receive VoIP calls. Thus, the MTA does not provide the same degree of mobility that a cellular phone does. Rented cell phones also are not associated with the traveler's "reach" telephone number. Travelers provide their temporary foreign cellular phone number to associates who use it for the duration of the trip. Certain countries (e.g., India) have outlawed the use of phone-to-phone VoIP services by prohibiting the installation and operation of formally established local VoIP Gateways.

[0007] Current solutions provide only a fraction of the possible synergistic features attainable by interrelating cellular services and packet telephony. Most current solutions forward incoming packet-telephony calls to a subscriber's cellular phone based on a set of predefined rules. Other solutions address the combination of cellular telephony and VoWLAN (Voice over Wireless LAN), mostly through the use of dual-mode wireless devices.

SUMMARY OF THE INVENTION

[0008] The present invention accelerates telephony service convergence by leveraging the advantages of the individual telephony technologies. More particularly, one embodiment includes an MTA/Cellular (MTAC) device having a cradle (or other power/signaling/media connection equipment for a cellular device), and a platform, which includes at least part of a service platform and optionally also databases. A platform, as used herein, includes one or more of software (including operating systems, applications and databases) and hardware (including switches, controllers/processors, input/outputs, and databases) to enhance an MTA for enabling the disclosed features and functions of the present invention.

[0009] As used herein, the term cellular phone shall be used in lieu of the term "cellular device". "Cellular phone" includes such equivalent terms as cellphone, cell-phone and cellular telephone. Corresponding devices may have: dual functions of analog and/or digital media and signaling; video and still picture capture, transmission and reception; streaming audio and/or video; data file handling; and other multimedia capabilities.

[0010] Additional interrelationships between cellular and Internet Protocol (IP) services are especially important in view of the present and expected competition between regional telephone companies and cable providers. For example, some regional telephone companies operate their own cellular services (e.g., Verizon). This enables them to offer "triple-play" bundles of wireless and wireline communications along with Digital Subscriber Line (DSL) broadband internet access. By at least partly solving this problem of needed interrelationships between cellular and IP services, the present invention provides cable companies with an incentive to partner with cellular carriers, or become Mobile Virtual Network Operators (MVNOs). Such cooperation enables the offering of a "quadruple play"—a bundle of television, broadband, telephony, and cellular services.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] A more complete appreciation of the present invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

[0012] FIG. **1** depicts a user environment using conventional components, taken from the viewpoint of the communication service users, which figure is useful in identifying problems in and analyzing the causes of such problems of known systems, which identifying and analyzing are part of the present invention;

[0013] FIG. **2** depicts another known user environment, taken from the viewpoint of the communication service users, which figure is useful in identifying problems in and

analyzing the causes of such problems of the known system, which identifying and analyzing are part of the present invention;

[0014] FIG. **3** depicts an environment of one or more subscribers to the present embodiment, taken from the viewpoint of the subscribers, who are the communication service users, according to an embodiment of the present invention;

[0015] FIG. **4** depicts components of the subscriber environment of the present embodiment, particularly the MTAC Cradle and the separate, partially built-in, or built-in platform enabling features provided by the present embodiment in interacting with various networks;

[0016] FIG. **5**A depicts a cellular device, particularly a cellular phone, nestled in an MTAC Cradle according to one embodiment, with the cellular phone having an electrical connection with the MTAC Cradle via a physical plug that unplugs upon removal of the cellular phone;

[0017] FIG. **5**B depicts the electrical connection between the MTAC Cradle and the cellular phone and showing a cord that is part of the connection;

[0018] FIG. **5**C depicts an electrical connection for interconnecting the MTAC Cradle with the cellular phone and showing a cordless connection that is part of the interconnecting of the cellular phone and the MTAC Cradle;

[0019] FIG. **6** is a schematic representation of the interface between the MTAC Cradle and the cellular phone, which in one embodiment is the electrical connections of FIGS. **5**A and **5**B for wire link and cordless connections;

[0020] FIG. **7** is a flow diagram of the operation of one embodiment, wherein the MTAC Cradle, platform and cellular-phone registration process extends the service internationally;

[0021] FIG. **8** is a flow diagram of the operation of one embodiment of a Service Platform controlling the making of outgoing calls, from the Subscriber Environment, when the cellular phone is in the MTAC cradle;

[0022] FIG. **9** is a flow diagram of the operation of one embodiment of a Service Platform controlling the making of outgoing calls, from the cellular phone **307**, when the cellular phone is not in MTAC Cradle **305**;

[0023] FIG. **10** is a flow diagram of the operation of one embodiment of a Service Platform controlling incoming calls to the subscriber's "one number";

[0024] FIG. **11** is a flow diagram of the operation of one embodiment functioning as a personal gateway;

[0025] FIG. **12** shows the MTAC IPG (IP Gateway) Cradle as a personal, multimedia IP communications (VoIP) portable gateway, which can accompany the subscriber abroad;

[0026] FIG. **13** shows a known MTA IPG;

[0027] FIG. **14** shows further details of a MTAC IPG Cradle **1430**, which is similar to MTAC IPG Cradle **1230**, but additionally includes a built-in DSL modem supplanting or supplementing broadband connectivity mechanisms such as Ethernet.

[0028] FIG. **15** is a schematic showing of the functionality of an International Service Federation or Clearinghouse to coordinate the use of an MTAC IPG Cradle domestically and when traveling abroad;

[0029] FIG. **16** is a schematic representation of the major components of the MTAC IPG Cradle; and

[0030] FIG. **17** is diagram of a cellular network which improves quality of service by reducing the number of end-to-end transcodings stages performed within the system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views.

[0032] The user environments depicted in FIGS. **1** through **3** are not intended to connote completeness. For the purpose of those figures, such user environments constitute an exemplary subset of the access and devices useable with the present invention. A more detailed configuration of the environments of FIGS. **1** to **3** would include additional devices such as PCs and other home-networked devices. These additional devices, when present, are connected through a wired or wireless LAN and a router or a switch (not shown).

[0033] FIG. **1** depicts a user's telecommunication access environment **100** that includes a plain telephone **101** (aka a POTS telephone) connected to the PSTN **120**, a cellular phone **107** connected to a cellular network **110**, and another Plain Telephone **103** connected to the PSTN **120** by way of a MTA **105** and an IP-network **115**. Cellular phone **107** communicates using at least one desired session type, e.g. voice, messaging, web, and audio or video streaming. Alternatively, Plain Telephones **101** and **103** may instead be single, 2-line instruments, where one line is connected to the MTA, and the other is connected directly to the PSTN (using an analog or ISDN connection).

[0034] MTA **105** may make Plain Telephone **103** the equivalent of a Session Initiation Protocol (SIP) phone, such as a Voice over Internet Protocol (VoIP) phone conforming to the description in the Internet Engineering Task Force (IETF) Request For Comment (RFC) 3216 and related RFCs. Phone **103** (or phone **103** and MTA **105**) may alternatively be a general-purpose computer with correspondingly conforming software. The access to Internet Protocol (IP) Network **115**, a special case of packet networks in general, may be provided through a wired or wireless transmission link. In the end-user environment of FIG. **1**, separate relationships are usually established with the providers of each network (packet IP Network **115**, Public Switched Telephone Network (PSTN) **120**, and Cellular Network **110**).

[0035] In certain cases, service providers offer cross-access-networks synergistic value. For example, based on a user-tunable set of rules, some providers of packet telephony permit the redirection of incoming calls to the user's cellular phone through the cellular network **110**. Currently known MTAs permit selecting the access network used for outgoing calls between packet-network **115** and PSTN **120**, with access depending on the MTA switch settings and/or a user-tunable set of rules. These rules allow the user to trade

off quality of service (QoS) and cost, and to conduct multiple concurrent sessions from the user environment **100** (e.g., when using both lines of a two-line phone or two separate single- or two- line phones).

[**0036**] FIG. **2** depicts another user's telecommunication access environment **200** that includes additional known devices. A Cellular-PSTN Gateway (CPG) cradle **209** is provided for the user's cellular phone **207**. Known CPG cradles include CellSocket, PlugCell, RCA Cell Docking System, and Dock-N-Talk. A CPG cradle enables one or more plain telephones **201** to communicate via the cellular network **110** in order to take full advantage of cellular service pricing packages. In one arrangement, the user foregoes PSTN services altogether by disconnecting the link between the plain telephone **201** and the PSTN **220**, and then using the CPG cradle **209** to enable all incoming and outgoing communications over the cellular network **110**. The CPG cradle **209** is directly connected to plain telephone **201** by a physical wire transmission link (wireline), thereby providing gateway functions suitable for using the cellular network **110** (through cellular phone **207**) from or to the plain telephone **201**. CPG Cradle **209** is typically used for both incoming and outgoing calls, and a direct electronic connection between the cradle and the cellular phone permits both pushbutton signaling and voice communications to be transmitted between the devices.

[**0037**] In another arrangement, plain telephone **201** is connected via one transmission link for one number to PSTN **120** and another transmission link for another number to CPG Cradle **209**, which permits, via toggle or pushbutton, access to two or more phone lines, thereby availing the user of the choice between communicating via a cellular network **110** or the PSTN **120** network on a call-by-call basis. A similar arrangement can be provided by a multi-line plain telephone connected to the CPG cradle **209** with one line, and to the PSTN **120** with the other. Separate access to IP Network **115** (and its associated paraphernalia **103**, **105**) is optional, and this access may be used to reduce user communications costs under appropriate conditions, and/or to enable communications with the (residential or business) facility when the cellular phone **207** is not nestled in CPG Cradle **209** (e.g., when the user carries the cellular phone away from the physical facility), especially if plain telephone **201** is not connected to the PSTN **120**.

[**0038**] Another feature embedded in the CPG cradle **209** may include cellular phone battery charging. A second type of cradle (e.g., Cingular's FastForward) provides incoming-call rerouting capabilities by providing cellular hand-set presence information through the cellular network without providing gateway functionality. That is, incoming calls may be redirected to plain telephone **201** via the PSTN **120** as described in association FIG. **1**. However, this second type of cradle is not connected to plain telephone **201** but rather relies on switching related to the cellular network **110** to forward the incoming call via PSTN **120**.

[**0039**] FIG. **3** depicts the user's environment **300** of the present embodiment. Cellular phone **307** is shown placed in an MTA/Cellular (MTAC) Cradle **305**. The MTAC Cradle **305** is connected to the IP Network **115** via a broadband connection. Broadband (exemplary forms of which are via cable, DSL, or wired/wireless alternatives) connotes a connection (always-on) with sufficient bandwidth & quality of service (QoS) for the desired communication sessions to be made possible by the MTAC Cradle **305**. Plain telephone **101** and PSTN **120** connectivity, however, are not necessary. Plain Telephone **101** and Plain Telephone **103** may be a single, 2-line Plain Telephone **103**, where one line is connected to the PSTN **120**, and the second to MTAC cradle **305**. A modification of the FIG. **3** environment is obtained by replacing the plain telephone **103** and MTAC Cradle **305** by an integrated SIP phone and MTAC Cradle (collectively, also a MTAC Cradle **305**), which has a similar cellular-device cradle. Also, the MTAC Cradle **305** may be constructed of the MTA **105** that is modified to connect to a peripheral cellular phone cradle (not shown).

[**0040**] The MTAC Cradle **305** establishes or determines the presence of the cellular phone **307**. Herein, the presence refers to the cellular phone being within operatively connected distance to the MTAC Cradle **305** as described with respect to FIG. **5**A, **5**B, **5**C for transmission and reception, i.e. exchange, of signaling and media as described with respect to FIG. **6**. Presence determination may be by sensing the occurrence of the wired or cordless signaling of FIG. **6**. Sensing may be of (1) a change in current or voltage of the DC power, (2) the cellular phone **307** being in the MTAC Cradle **305** as in FIG. **5**A or otherwise operatively electronically connected as in FIGS. **5**B and **5**C, (3) the manual activation of a switch on MTAC Cradle **305**, and/or (4) automatically through a form-factor activated switch in the MTAC Cradle **305**. Form-factor activation may constitute a micro-switch activated by the cellular phone weight or the pressure exerted by the cellular phone **307** when nestled in MTAC Cradle **305**, or by a change in capacitance caused by the presence of the cellular phone **307**. Form-factor activation, capacitance sensing and manual switching are not as secure for establishing presence as the other ways, since they neither identify the nestled object as a cellular phone, nor authenticate particular cellular phones.

[**0041**] When presence is determined, presence information is communicated over the IP Network **115** or by the cellular phone **307** over the cellular network **110** (e.g., via a Short Message Service (SMS)) to a back-end infrastructure. The presence information may include authentication and functionality identification, for example a unique user code, a model number, a serial number or codec capabilities. By way of example, a user code or device number may be used to indirectly convey functionality identification, such as a cellular phone built-in codec capability.

[**0042**] The electronic connection between the cellular phone **307** and the MTAC Cradle **305** is established through a physical plug (FIG. **5**A directly or FIG. **5**B with an intervening cord, for example) or through a cordless transmission link (FIG. **5**C, for example), such as a very-short-range wireless transmission link. Such very-short range links include Bluetooth links, conforming to the Institute of Electrical and Electronics Engineers (IEEE) standard 802.15.1 (IEEE 802.15.1) for Personal Area Network technology. Moreover, additional technologies may be used for cordless transmission, including Radio Frequency Identification (RFID), and Infrared. RFID standards are discussed in materials of the Association for Automatic Identification and Mobility. The electronic connection between the cell phone **307** and the MTAC Cradle **305** enables the flow of DC power (by induction in the cordless case for battery charging

or operation), signaling, and media (i.e. information, e.g., computer data, audio or video streaming, graphics, and voice), as shown in FIG. **6**.

[**0043**] The MTAC Cradle **305** enables the subscriber to make and receive calls via the cellular network **110**; the MTAC Cradle **305** is used to access the cellular phone **307**, thereby providing functionality similar to that of the CPG Cradle **209** of FIG. **2**. When functioning in this manner, the MTAC Cradle does not process voice/media for delivery over the IP Network **115**, i.e. it does not provide VoIP functionality.

[**0044**] A less capable version of the MTAC Cradle **305** does not provide media connectivity to the cellular phone **307**. The cradle of the less capable version of the MTAC Cradle **305** merely provides cellular phone charging capability (DC power or inductive means in FIG. **6**) and cellular phone presence detection. Such presence may be established in the manner discussed above. Except for providing for access to VoIP services, this less-capable MTAC Cradle **305** has functionality that is similar to the functionality of the Cingular's FastForward. However, the less-capable MTAC Cradle **305** transmits presence and forwarded-phone number information to the forwarding server platform through the IP network **115**, thus eliminating the need for specialized cellular-phone applications.

[**0045**] MTAC Cradle **305** differs from the usual MTA **105** in additional important aspects. For example, plain telephone **103** can access the cellular network **110** by passing its analog media stream and signaling information (e.g., Dial Tone Multi-Frequency (DTMF)) directly through the MTAC Cradle **305** to cellular phone **307**, and when this happens, the MTAC Cradle **305** bridges the plain telephone **103** and cellular phone **307** directly without using the MTAC's gateway functionality. That is, the media of the plain telephone **103** is neither encoded nor packetized by the MTAC Cradle **305** when being delivered to/from the cellular phone **307**, and the IP network is not used. In the preferred embodiment, the MTAC Cradle **305** includes a display screen and appropriate user inputs to ease the subscriber's experience of service programming and option selection, i.e., to make the MTAC Cradle **305** user friendly.

[**0046**] The preferred embodiment also permits the authenticated online subscriber to attend to various aspects of the service (mainly subscriber-alterable fields in the Subscriber Profile, Preferences, Presence (PPP) database **450** of FIG. **4**), through an online PC, the built-in display and user input (e.g. a keyboard) of FIG. **16**, or equivalent device that is independent from the MTAC Cradle **305**. In an alternative embodiment, an offline PC may be used for this purpose when connected directly to the MTAC Cradle, e.g., through a USB connector.

[**0047**] FIG. **4** depicts the major components of the subscriber environment of one embodiment, and an exemplary platform. Platforms are one or more of the application and other functional software, operating system and hardware.

[**0048**] The conventional "user environment" of FIGS. **1** and **2** is transferred into a "subscriber environment" in FIGS. **3** and **4** by utilizing an MTAC Cradle **305** and a subscription.

[**0049**] The illustrated embodiment enables a subscriber to advertise a single reach identification, for example a reach address or reach number, which could be an Internet Protocol (IP) address or a telephone number. The cellular device might be a cellular phone (reachable by number), or multimedia devices that include data capabilities such as a Short Message Service (SMS), e-mail, Web access, etc. A more general example of reach identification is a Session Initiation Protocol (SIP) Address. The reach identification, address or number is registered to one or more providers of IP-based communication services, e.g., a VoIP service provider or an Internet Service Provider (ISP), and is stored in Service Providers database **465** with an index to the subscriber PPP database **450**.

[**0050**] Examples of multiple providers of IP-based communication services where the same unique identification may be registered are the providers of VoIP services and of value-added applications on top of VoIP that are distinct. The registration is an example procedure for assuring that all incoming sessions are processed by the Service Platform **435**. In this preferred embodiment the user/subscriber may bring a pre-existing reach number identification (e.g., telephone number) to the service. Identification and/or authentication may be assigned to a new subscriber upon request.

[**0051**] As shown in FIG. **4**, a SoftSwitch is a type of switch capable of both circuit and packet switching, for use over the PSTN and, for example, IP Networks, respectively. A gateway is an electronic intermediary that intercepts and steers electronic signals from one network to another, which in addition may perform signal shaping and code or protocol conversion between otherwise incompatible networks. The SoftSwitch and Gateways **430** provide session routing and bridging capabilities across the three networks shown, that is the: Cellular Network **110**, IP Network **115** and PSTN **120**. (Bridging permits the parking of incoming or outgoing call legs and then connecting (bridging) them with one or more other outgoing or incoming legs of the call/session.) The gateways need not be collocated with the SoftSwitch, but rather could be distributed in a convenient manner along the media paths of communications, particularly where dissimilar networks intersect. In the exemplary embodiment, the SoftSwitches are collocated with the gateways. Whether collocated with the SoftSwitch or not, it is preferable that the media gateways are under the direct control of the SoftSwitch and SIP Proxies **425**.

[**0052**] At least one SIP Proxy **425** interoperates with MTAC Cradle **305** (e.g. with a SIP phone) according to the SIP standards as defined in Request for Comments (RFC) 3261 and related RFCs. Both SoftSwitch **430** and the at least one SIP Proxy **425** operate under the control of Service Platform **435**.

[**0053**] Whether the following databases are wholly or partially front-ended by being within the MTAC Cradle **305** as in FIG. **16** or wholly or partially back-ended by being external to and connected by the IP Network **115** to the MTAC Cradle **305** as shown in FIG. **4**, the Service Platform **435** proxies of FIG. **16** communicate with several databases for populating them, and storing, altering and retrieving data.

[**0054**] The AAA (Authentication, Authorization and Accounting) Subscriber Accounts database **440** maintains subscriber service-usage and billing information. Where necessary (e.g., when components of the service are provided by others), AAA Subscriber Accounts database **440** interfaces with similar systems dedicated to cellular service

providers, PSTN service providers, and perhaps other, value-added service providers. Current AAA solutions focus on Remote Authentication Dial-In User Service (RADIUS) and its follow-on Diameter protocols. The Service Platform **435** uses the AAA Subscriber Accounts database **440** to ensure that the user is a subscriber in good standing, and to record all billable transactions as they occur and thus includes one or more databases that are remote or resident with respect to the MTAC Cradle **305**. The AAA Subscriber Accounts database **440** is preferably used to produce billing documents and to record subscriber payments in cooperation with the database Payments Clearing **445**. The reach identification may be a key to the AAA Subscriber Accounts database **440**.

[**0055**] The Subscriber PPP (Profile, Preferences & Presence) database **450** contains all subscriber-specific information. It is populated upon service provisioning and is maintained by the subscriber as profile and preferences change. As verified and approved by the service provider, subscriber access preferably is accomplished through the World Wide Web (WWW, which is an application of the IP Network **115**). In other preferred embodiments, the subscriber may use interactive-voice response systems and/or other information providing and updating means like SMS. The latter is aided by the added mode of subscriber authentication enabled by associating the updating cellular device with the Subscriber PPP database **450**. The Subscriber PPP database **450** includes details of terminal equipment (e.g., handsets) used by the subscriber, services subscribed to (e.g., one number or follow-me routing), geographic location of user devices (permanent and temporary), subscribed services & packages, subscriber rules of service behavior under specified conditions, and other relevant details. Subscribers to the service obtain secure authentication means upon service provisioning. Subscribers are permitted to access certain portions of the Subscriber PPP database **450** to populate and alter their profile and preferences data. The systems protect against all other access, data contamination, or denial-of-service attacks by known means. The reach identification may be a key to the Subscriber PPP database **450**.

[**0056**] The Service Providers database **455** contains the details of all service providers participating in the integrated service packages made available to the subscribers, for example, services by PSTN carriers, VoIP service providers, cellular carriers, and geographic-association service providers. Though, in the illustrated embodiment, the service is described from the viewpoint of a VoIP primary carrier or integrator, the illustrated embodiment is exemplary and the illustrated embodiment is not meant to limit the primary service provider to any one or combination of specific service providers, perhaps including roaming-service providers.

[**0057**] The illustrated embodiment uses the subscriber's identification associated with the incoming calls, for example the subscriber's well-advertised reach number, which has been assigned so as to route calls via the Service Platform **435**. The Service Platform **435** operator would usually be a VoIP carrier or value-added service provider. Local service providers with whom agreements are desired include broadband access providers and cellular carriers or resellers.

[**0058**] The Payments Clearing database **445** keeps track of amounts owed across Service Providers based on the individual service provider's portion of pre-agreed payments for services.

[**0059**] Periodically, the amounts owed across Service Providers are trued and payments tracked by processes performed by the Service Platform **435**. Where payments are not cleared within contracted periods, data within the Payments Clearing **445** database causes the Service Platform **435** to remove the offending service provider from available Service Providers database **455**, and thereby the Service Platform **435** stops assigning services to that removed service provider until the situation is cleared up and the removed service provider is re-entered into the Service Providers database **455**.

[**0060**] The Messaging Platform database **465** is used by the Service Platform **435** for storing and retrieving subscriber messages of appropriate incoming session media, according to subscriber preferences stored in the Subscriber PPP database **450**. The platform can also be used for providing the subscriber with outbound messaging services (including group distributions), not further discussed in this embodiment.

[**0061**] The Geographic Association database **460** provides data supporting Service Platform **435** in associating originating and terminating identifications, for example reach identifications, for example, reach numbers or reach addresses, (e.g., phone number(s) or IP Address(es) assigned to each MTAC) with approximate geographic, national, and regional boundaries with sufficient granularity for associating particular service providers with desired services. The Geographic Association database **460** contains the required associations; alternatively, the database **460** represents a service provided by one or more external entities, which may enhance or supplant the database. For example, the Geographic Association database **460** associates an IP address assigned to a subscriber's SIP device with the appropriate geographic region that is covered by one or more participating (e.g., listed in Service Providers database **455**) cellular carriers or cellular-service resellers. In another example, geographic information provided by a cellular carrier (a service provider) on the approximate location of a subscriber's cellular device (obtained for example from cell-site antenna triangulation or embedded GPS circuit known in the art) is used to determine the appropriate routing of an incoming call by the Service Platform **435** based upon the rule base stored in Subscriber PPP database **450**. Furthermore, when devices are collocated (e.g., when cellular phone **307** is nestled in MTAC Cradle **305**), the correlation of both location data derived from these independent sources increases the reliability of geographic information and helps to reduce fraud. The Geographic Association database **460** and the AAA Subscriber Accounts database **440** are used by the Service Platform **435** to rate (i.e., establish specific price) sessions when the cost depends at least partially upon geography. The information may subsequently be used to clear payments across service providers through Payments Clearing **445**.

[**0062**] Two or more or all of the databases **440**, **445**, **450**, **455**, **460** and **465** may be combined into a single or plural database or otherwise centralized; for example, fractions or whole parts of one or more of the databases may be located

physically within the MTAC cradle **305** as a part of a front-end service platform residing in and operating under the controller of the MTAC Cradle **305**, FIG. **16**. One or more of the databases **440**, **445**, **450**, **455**, **460** and **465** may be divided or redundant according to various purposes known to database implementation, and the redundancies and divisions may be a part of the front-end service platform residing in and operating under the controller of the MTAC Cradle **305**, FIG. **16**. The databases **440**, **445**, **450**, **455**, **460** and **465** may be physically distributed and connected by networks, such as the IP network **115**. In centralized control locations, Service Platform **435** may be connected to its associated databases **440**, **445**, **450**, **455**, **460**, and **465** via very fast networks (e.g., high-speed Ethernet) over fast media (e.g., employing fiber-optic cable), deploying such fast server-to-database architectures as NAS (Network Attached Storage) or SAN (Storage Area Network). Service platforms and databases may contain redundant elements that are controlled to improve system availability under adverse conditions. One or more of the SIP Proxies **425**, SoftSwitch & Gateways **430** and Service Platform **435** may be integrated within the MTAC cradle **305** as the proxies shown in FIG. **16**.

[**0063**] FIGS. **5**A, **5**B and **5**C respectively illustrate user-selectable interconnections of the MTAC Cradle **305** with cellular phone **307**. FIGS. **5**A and **5**B represent exemplary cellular phone connections of a single embodiment, shown in FIG. **16**, wherein the cradle and phone are provided with complementary plugs to be directly interconnected (FIG. **5**A) or indirectly interconnected with the interposition of a cord with corresponding plug ends (the cord being removed in FIGS. **5**A and **5**C or being coiled within the cradle in FIG. **5**A). FIG. **5**C provides an alternate, cordless connection which is in use when the wired connections are sensed as not being in use. Alternatively, only one or two of the three connection methods can be deployed per MTAC Cradle **305**/cellular phone **307** combination.

[**0064**] In FIG. **5**A, the cellular phone **307** is nestled in the built-in cradle of the MTAC Cradle **305**. The transmission link (for DC power, signaling and media as in FIG. **6**) between the cellular phone **307** and the MTAC Cradle **305** is via a physical plug (not shown, but conventional) in FIG. **5**A, or a hard-wired link connection as in FIG. **5**B, or a cordless connection as in FIG. **5**C. While the transmission links of FIGS. **5**A, **5**B and **5**C may be mutually exclusive alternatives, any two of them or all three of them may be combined. For example, a single cellular phone **307** and a single MTAC Cradle **305** may each have mating plugs to directly engage as in FIG. **5**A, a removable cord with complementary plug endings for direct wired connection as in FIG. **5**B and a cordless connection that is activated manually or automatically when the connection of FIG. **5**A or **5**B is broken and presence of the cellular phone **307** is otherwise detected.

[**0065**] In FIG. **5**B, the cellular phone **307** is operated as a corded phone. In one version, the wired connection basically extends the arrangement of FIG. **5**A via a cord. The arrangement of FIG. **5**B is useful when the cellular phone is used in conjunction with the MTAC Cradle **305**, for example, when used in a special mode as a replacement for the Plain Telephone **103** of FIG. **3**, in providing an audio or voice interface to the IP network **115**. Both the corded version or the MTAC Cradle **305** of FIG. **5**B and the cordless version of FIG. **5**C have the capability for analog communications and analog signaling to the cellular phone. This analog mode of communication may be enabled or disabled by a manual switch provided on the cellular phone **307** or by conveying the "analog enabled" or "analog disabled" information by the MTAC Cradle **305** sensing that a plain telephone **103** is or is not connected to its plug (e.g., an RJ-11 plug) or through a cordless mechanism. The MTAC Cradle **305** that is without an RJ-11 outlet for plain telephones would signal the enabled/disabled information to the cellular phone as a constant input.

[**0066**] One example of the FIG. **5**C cordless transmission link connection is Bluetooth, in which the Cordless Telephony Profile (CTP), issued by the Bluetooth Special Interest Group (Bluetooth SIG—a Trade Association). Bluetooth can be used to convert the cellular phone to a 100-meter-range cordless phone when needed. The CTP capability is advantageous for travelers, who then would not have to rely on the availability of an analog telephone for using the MTAC **305** in places like hotel rooms. Examples of other short-range wireless networks that can be used for the cordless connection include Ultra Wide Band (UWB), and wireless Universal Serial Bus (USB). The cordless connection of FIG. **5**C most preferably remains on, i.e., powered and operative, whether the cellular phone is in the cradle as in FIG. **5**A or out of the cradle as illustrated in FIGS. **5**B and **5**C. This is not necessary when the MTAC is provided with a cradle and a plain telephone combined in the form of a VoIP telephone with a cellular-telephone cradle. The cordless connection has the advantage of thereby removing the need for plugging in a plain telephone **103** for communicating over the IP network **115**. It has a further advantage of avoiding physical interface plug mismatches, which may occur in the FIG. **5**A arrangement if the cellular phone **307** did not have a plug that was compatible to the plug of the MTAC Cradle **305**.

[**0067**] FIG. **6** illustrates the functional interfaces of direct current (DC) power, signaling and media that are provided between the MTAC Cradle **305** and the cellular phone **307**. DC Power sourced from the cradle and delivered to the cellular phone enables the battery of the cellular-phone to be charged when the cellular phone is nestled in the cradle as in FIG. **5**A or wire-connected as in FIG. **5**B. DC power is not normally provided to the cellular phone **307** from the MTAC Cradle **305** in the case of FIG. **5**C, although it could be provided cordlessly through means known in the art (e.g., inductance, photonic power . . .). Signaling is provided both ways between the cellular phone **307** and the MTAC Cradle **305** for various control functions. Media or data transmission is provided both ways between the cellular phone **307** and the MTAC Cradle **305** for exchanging information.

[**0068**] In the FIG. **6** signaling interface, examples of information signaled from the cellular phone **307** to the MTAC Cradle **305** include the following: state information, such as presence; cellular service availability; on-hook or off-hook; cellular phone identification; Automatic Number Identification (ANI) of the calling party; selective content of the programmed details in the Subscriber Identification Module (SIM), which is a smart card residing in cellular phones, e.g., containing all subscriber-related data; and programming related information, including selective information relating to encryption and decryption.

[0069] In the FIG. **6** signaling interface, examples of information signaled from the MTAC Cradle **305** to the cellular phone **307** include the following: Go off-hook or Go on-hook; Probe for cellular phone identification; Accept dial string from MTAC Cradle **305**; Push dial string and initiate conversation; Initiate or terminate media-stream sharing with the MTAC Cradle **305**; Exchange analog media or exchange encoded digital media (optional); Add or terminate a party for multi-party conferencing; and Subscriber Identification Module (SIM) programming-process instructions.

[0070] In the FIG. **6** media interface, the media exchanged between the MTAC Cradle **305** and the cellular phone **307** may be analog and/or digital (data and/or encoded voice). For example, the media may be: digitally encoded GSM (e.g., voice) media or analog voice media, with a signaling interface, which permits a plain telephone **103** to access the cellular network via the cellular telephone **307**. (GSM formerly stood for Group Special Mobile and today stands for Global System for Mobile Communication, which is a standard digital cellular phone service in many countries) Digitally encoded media require compatible codecs (coders/decoders) for sessions involving analog devices or mismatched digital devices. Gateway devices (such as MTAC Cradle **305**) are used to encode and packetize analog voice and/or image and video media. Most cellular phones contain provisions for exchanging analog media, because they must interface to analog devices enabling hands-free mode use in cars.

[0071] In SIM Programming: the data listed above as examples of the "signaling" interface enables the secure programming of the SIM card residing in, for example, GSM "World Phones". When a subscriber travels to an area that is served by a partnering cellular-service carrier, the SIM card embedded in the cellular phone **307** is replaced by one provided by the partnering carrier. In another preferred embodiment, the SIM card can be reprogrammed to operate in the geopolitical area covered by the partnering carrier. In general, a SIM Module embedded in a cell phone can be OTA (Over-The-Air) programmed by the cellular carriers that it is directly associated with. The programming of the present embodiment introduces security considerations not normally present. The SIM may need to be provisioned for operation by a cellular-service operator that has not originally provisioned the cell phone. In one such more secure preferred embodiment, the MTAC Cradle **305** is capable of programming the SIM Module embedded in cellular phone **307** when the latter is physically connected to the cradle (FIGS. **5**A or **5**B). In another preferred embodiment, the OTA method is followed, but only if, concurrently, the MTAC Cradle provides a SIM-unlocking signal provided by Service Platform **435**. The availability of two separate communication channels (the cellular network and the IP network), improves the probability that the SIM will be programmed in the appropriate, authenticated cell phone as part of this embodiment. In another preferred embodiment the two separate channels are used to exchange complementary fractions of encryption and decryption keys. This aspect of the invention only applies to cellular devices that enable SIM-card programming. The MTAC Cradle **305** can cordlessly (FIG. **5**C) transmit SIM programming information to cellular phones **307** that are capable of altering their SIM programs in response to wireless instructions.

[0072] In the FIG. **6**"DC power" interface, the MTAC Cradle **305** may preferably supply exotic power and voltage requirements as might be required for secure SIM programming; this provides another method to program the most secure portions of SIM cards, where OTA is insufficient for the required security. Thus, OTA can be used for run-of-the-mill, normal updates of the SIM card by the original provider of the Cell phone, whereas exotic power and voltage requirements may be used to program the more secure information embedded in the SIM card, e.g., the transition from one cellular carrier to another.

[0073] Case 1: FIG. **8** depicts an example of the process of making outgoing calls from the Subscriber Environment.

[0074] User preference (as probed in step **802**) is embedded in the MTAC Cradle **305** prior to the making of an outgoing call as described herein. User preference is established through manual subscriber/user input or manual manufacturer's input; input is preferably through, for example, a keyboard, switch(es), touch pad, voice command, software (for example, a website hosted for this purpose by MTAC Cradle **305**), firmware, and other hardware of the MTAC Cradle **305** during use, manufacture, and/or time of sale or lease.

[0075] The programmed process may be started in any number of conventional ways of initiating a call or started by step **801** directly. In the illustrated embodiment, the Service Platform **435**, SoftSwitch & Gateways **430** and SIP Proxies **425** are built into or resident in the module of the MTAC cradle **305**, but one or more or all of their functions may be separate from the MTAC cradle **305** and executed at the same or remote locations. In any event, the present invention (e.g., using the Service Platform **435**) performs the example process of FIG. **8**.

[0076] STEP **801**: The user keys the dial string into plain telephone **103**. The MTAC Cradle **305** previously received an earlier indication of user preference between: 1) forced use of a particular network; and 2) automatic program determination of network choice.

[0077] STEP **802**: The MTAC Cradle **305** captures the dialed string from the Plain Telephone **103**, and probes the presence and status of a connected cellular phone, and the user's manual input choice of: 1) cellular network **110**, 2) IP network **115**, or automatic program determination of network choice. If there is no cellular phone connected (wired or wirelessly) to the MTAC Cradle, or if the user preference calls for forcing an IP call, the process proceeds to step **804**. If the user preference calls for forcing a cellular call, the process proceeds to step **808**. If the user preference indicates automatic program determination of a network choice, the process proceeds to step **803**.

[0078] STEP **803**: The MTAC Cradle **305** signals to Service Platform **435** via IP Network **115**.

[0079] The signal contains the MTAC Cradle's identity, current IP address, the string to be dialed, the presence (if any) and status of the connected cellphone, and the nature of the signal (i.e., "choose best network"). Though the Service Platform and the SIP proxies are associated with the MTAC Cradle on provisioning, the association can be reprogrammed as needed through hardware/software residing at service-provisioning centers.

[0080] STEP **805**: The Service Platform **435** selects the best routes from among the Service Providers identified in database **455**, for example, based upon least-cost routing (LCR). The details of the plans are stored in Subscriber PPP **450**. Depending on preferences stored in Subscriber PPP **450**, the conditions of the call may require that a level of expected QoS override pure LCR. The rule base of Subscriber PPP database **450** may include service-provider imposed conditions. For example, depending on the status of the subscriber's account information stored in AAA Subscriber Account database **440**, the Service Platform **435** might override a subscriber's preference for higher QoS at a higher cost, thus reducing the exposure of the service provider to a non-payment risk. Cellular service contracts often include special cases (e.g., free calling among subscribers to affiliated services). The illustrated embodiment takes advantage of these special conditions by incorporating them into the rule base in Subscriber PPP database **450**. Thereby, the Service Platform **435** determines the appropriate route, and signals the choice (via steps **806** or **807** below) back to MTAC Cradle **305** through the IP network **115**. Service Platform **435** may choose the cellular network only if MTAC Cradle **305** had indicated the presence of cellular phone **307** as part of its best-route request.

[0081] STEP **806**: When the preferred route is the IP network **115**, the Service Platform **435** signals to the MTAC Cradle to initiate a session through the SIP Proxy **425** (STEP **804**). Appropriate media Gateways **430** may be engaged by the SIP proxy **425** when network transition is needed, for example, from VoIP to PSTN.

[0082] STEP **804**: When an IP call has been selected, the MTAC Cradle **305** used the dial-string to initiate a SIP session via SIP Proxies and control passes to STEP **809**.

[0083] STEP **809**: The VoIP session proceeds from Plain telephone **103**, and upon termination concludes with STEP **811**.

[0084] STEP **807**: When the preferred route is via the cellular network **110**, Service Platform **435** signals to the MTAC Cradle **305** to send the dialed string through cellular phone **307**. This cellular preference may take advantage of cellular contract packages, and can only be invoked when the MTAC Cradle **305** had indicated the presence of cellular phone **307** in the cradle; this presence condition is stored in Subscriber PPP database **450**, and is probed by Service Platform **435** as part of STEP **805**.

[0085] STEP **808**: To initiate the call via the selected cellular network, MTAC Cradle **305** signals to Cellular Phone **307** to go off hook, following by the dial string, and the SEND or CALL command (as usually depicted on a cellular phone's keypad).

[0086] STEP **810**: The cellular session proceeds to its conclusion, followed by STEP **811**.

[0087] STEP **811**: Session completion is detected by the MTAC Cradle **305** regardless of the network type (cellular or IP) used in the session. The MTAC Cradle **305** signals Service Platform **435** that the session is complete. Platform **435** assures that the appropriate billing records are stored in AAA Subscriber Accounts **440**. Either periodically or in real-time, Payments Clearing database **445** is updated to reflect services provided by participating service providers.

[0088] Case 2: An example of making outgoing calls, from the cellular phone **307**, when it is not connected to MTAC Cradle **305** is illustrated in FIG. **9**.

[0089] One feature of the present disclosure is that all subscriber calls are directed via platforms (e.g., SSG (Soft-Switch & Gateways) **430** and/or SIP Proxies **425**) that are controlled by Service Platform **435**.

[0090] Case 2 requires that the subscriber is appropriately provisioned so as to ensure that the subscriber's billing and service profiles reflect the association between the cellular phone, and the service.

[0091] One of the provisioning steps ensures that the cellular billing platform managed by the cellular infrastructure owner, for example, the entity that provides the underlying cellular service provided by a Mobile Virtual Network Operation (MVNO). This step ensures that the cellular billing platform updates the AAA Subscriber Accounts database **440** in real time.

[0092] Another provisioning step ensures that the Subscriber PPP database **450** reflects the specific service and association between the cellular phone and the service.

[0093] Additionally, Subscriber PPP database **450** may be designed for quick, real-time transactions, in which case it may contain operational account data from AAA Subscriber Account database **440**, which may be designed for slower, non-real-time access.

[0094] STEP **900**: The subscriber dials the desired number string through the cellular phone's keypad, and completes by touching the common "send" button (or equivalent).

[0095] STEP **901**: All outgoing calls are signaled through the Service Platform **435**. Such forcing can be done thorough: 1) agreement with the cellular carrier for redirecting all calls through the service platform **435**; or 2) by ensuring that the cellular phone **307** always dials out such non-standard calls through the service platform **435**, for example by using explicit user-triggered double-dialing. Alternatively, implicit double-dialing can be accomplished through cellular phone programming, since the dial string leading to the Service Platform **435** can be fixed. The process continues to Step **902**.

[0096] STEP **902**: The outgoing call is routed by the Service Platform **435** in accordance with the rules of Subscriber PPP database **450** and the balance associated with the subscriber's account. In addition to balance and preferences, routing depends on the nature of the called session and its destination. When the Service Platform **435** selects terminating the call through the cellular network, the process continues in Step **903**. When the Service Platform **435** selects terminating the call through an alternative (PSTN **120** or IP **115**) network, the process continues in Step **904**. In general, barring preferential conflicts, flat-rate cellular calls are redirected through the cellular network **110**. If the call is addressed to a premium-priced number ("premium" is relatively defined in comparison to the subscriber's cellular service agreement), the process proceeds to Step **904**. Though the disclosure differentiates between an originating cellular network and other types of terminating networks, the present invention includes cases in which the terminating network is a cellular network that is operated separately from the originating cellular network.

[0097] STEP **903**: Routes call termination through the originating cellular network. The session begins in STEP **905**, and the process continues with STEP **906**.

[0098] STEP **904**: In this step, the Service Platform **435** routes the premium-priced call through inexpensive routes. For example, VoIP communication service can be used to route VoIP packets to the called number via a gateway residing in a location from which PSTN (or cellular service, if the called number is a cellular phone) is inexpensive. Such a location is usually the country in which the called party resides. Sometimes the inexpensive route is provided through the PSTN, especially when the quality dictated in the subscriber's PPP cannot be provided by VoIP. The session begins in STEP **905** and the process continues in STEP **906**. As discussed in Step **902**, STEP **904** may terminate calls through a cellular network other than that originating the call.

[0099] STEP **906**: When the session ends, the process continues in Step **910**. While the session continues, the process continues in Step **907**.

[0100] STEP **907** draws down on the subscriber's account balance as the session continues, and STEP **908** probes the sufficiency of that balance for continuing the session. If the balance is sufficient, the process returns to Step **906**. If the balance is insufficient, Step **909** terminates the session, and the process continues in Step **910**.

[0101] STEP **910**: At the end of the call session, Service Platform **435** updates the billing record associated with the subscriber in AAA Subscriber Accounts database **440**. This may be necessary because the instantaneously available balance is maintained in a real-time database in subscriber PPP **450**. Service Platform **435** updates the Inter-service-provider clearing payment records as needed (periodically or in real-time) in the Payments Clearing database **445**. Once the databases are updated, the process ends.

[0102] Case 3: Incoming calls to the subscriber's one number. In a conventional one number system, the caller calls a person using a single number, and a computer system dials a plurality of possible numbers serially, in parallel, according to the called subscriber's preferences, and/or according to the caller's responses to prompts, in an effort to locate the party being called. The party being called may be at or using a different device at different locations.

[0103] FIG. **10** is a flow diagram of the exemplary embodiment service for incoming calls to the subscriber's "one number".

[0104] STEP **1000**: When an incoming session is addressed to the subscriber's one number, the incoming call is directed to the Service Platform **435** via SSG **430**. This can be accomplished by registering the subscriber's one number with the operator of the subject of this disclosure, e.g., as a "responsible organization" for local-number portability.

[0105] STEP **1002**: SSG **430** feeds relevant (e.g., those used in Subscriber PPP to treat the call in prescribed ways) call parameters to Service Platform **435**. The subscriber's preferences, rules and presence information, as stored in Subscriber PPP database **450** are preferably used in the processing, particularly to determine if the call is required to be redirected.

[0106] STEP **1004**: Service platform **435** compares the call parameters (e.g., the originating device, network and/or person, the time of the call) to the rule base implied by Subscriber PPP **450**, and treats the accordingly. STEPS **1006**, **1010**, **1014**, **1018**, **1022**, **1026**, and **1028** are examples of possible call treatments. STEP **1004** also redirects failed call attempts according to the subscriber PPP **450**, based on the newly established conditions of failures. As dictated by preferences stored in the Subscriber PPP database **450**, the Service Platform **435** may redirect the call.

[0107] STEP **1006**: In a possible PPP-default (or PPP-prescribed) circumstance the incoming call is routed by the Service Platform **435** to terminate at MTAC Cradle **305** via IP Network **115**. If the incoming call is a PSTN Plain telephone call, this routing involves the insertion of a media gateway by SSG **430**. The process proceeds in STEP **1008**.

[0108] STEP **1008**: The subscriber's plain telephone **103** is rung through MTAC **305**. If the phone is answered, the session proceeds in the usual manner to its conclusion, and the Service Platform **435** updates AAA Subscriber Accounts. The latter action is independent of subscriber-account draw down (which may not be relevant for incoming calls), but is necessary to record the duration of sessions for which ultimate payments clearing with other service providers may be necessary (e.g., for charging a call termination fee to the originating-call carrier). If the call is not answered after a prescribed duration, control of the call returns to Service Platform **435** for further treatment based on the new condition of "no answer".

[0109] STEP **1010**: When plain telephone **103** is (also) directly connected to PSTN **120**, then Service Platform **435**, after consulting with Subscriber PPP **450**, may route the incoming call via the PSTN **120**. The process proceeds in STEP **1012**.

[0110] STEP **1012**: Plain telephone **103** rings; if the phone is answered, the session proceeds in the usual manner to its conclusion, and the Service Platform **435** updates AAA Subscriber Accounts. If the call is not answered after a prescribed duration, control of the call returns to Service Platform **435** for further treatment based on the new condition of "no answer".

[0111] STEP **1014**: Service Platform **435** routes the call to cell phone **307** via cellular network **110**. The subscriber's cell phone **307** is rung through the cellular network **110**. The process proceeds in STEP **1016**. In a preferred embodiment, the routing logic associated with Service Platform **1004** takes into account the carrier that issued the originating phone number, since certain cellular calling plans provide free airtime among plan participants, and the subscriber may gain from accepting he call over the cellular network; it is therefore advantageous if the "one number" is the subscriber's cellular phone number.

[0112] STEP **1016**: If the cell phone **307** is connected to MTAC Cradle **305**, the subscriber has a choice of responding by picking up Plain Telephone **103** or by going "off hook" on cellular phone **307**. If the subscriber is away from the Subscriber Environment **300**, the session is picked up via cell phone **307**. If the call is answered, the session proceeds in the usual manner to its conclusion, and the Service Platform **435** updates AAA Subscriber Accounts. If the call is not answered after a prescribed duration, control of the

call returns to Service Platform **435** for further treatment based on the new condition of "no answer".

[**0113**] STEP **1018**: When dictated by preferences stored in the Subscriber PPP database **450**, the Service Platform **435** redirects the call to a different destination, e.g., as is common in "follow-me" type services. The process proceeds in STEP **1020**.

[**0114**] STEP **1020**: The follow-me device rings. If the call is answered, the session proceeds in the usual manner to its conclusion, and the Service Platform **435** updates AAA Subscriber Accounts. If the call is not answered after a prescribed duration, control of the call returns to Service Platform **435** for further treatment based on the new condition of "no answer. This may sometimes include a sequence of other follow-me devices.

[**0115**] STEP **1022**: Service Platform **435** encounters a condition requiring a modification to the incoming session initiation attempt. For example, the call-initiation may be from a cellphone number that is listed in subscriber PPP **450** as preferring the use of the originally assigned cellular phone number (rather than the subscriber's one-number). This may desirable when the subscribed cellular service package includes unlimited free calling among some group of subscribers. Then the process proceeds in STEP **1024**.

[**0116**] STEP **1024**: Service Platform **435** informs (e.g., via text or voice message) the caller through the calling device (e.g., cellphone) of the need to restart the session initiation attempt in a different manner. Two preferred embodiments include (i) establishing a callback from cellphone **307** to the calling number; and (ii) signaling to the calling device the phone number to be used by the caller in a follow-up session-initiation attempt, and terminating present the incoming session-initiation attempt.

[**0117**] When embodiment (i) is used, and cellular phone **307** is connected to MTAC Cradle **305**, the following details one embodiment for generating the call-back. Service Platform **435** sends a message to the MTAC Cradle **305** over the IP Network **115**, which message includes "call the number provided herein through the (connected) cellular phone". The MTAC Cradle **305**, causes cellular phone **307** to go off hook and dial the caller's number while the MTAC Cradle **305** rings plain telephone **103**. Those skilled in the art can transform the method for integrated MTAC Cradle **305**/ telephone devices. The Subscriber picks up plain telephone **103** or takes the cell phone **307** off the cradle of MTAC Cradle **305** and listens to the ringing of the phone of the original caller. The subscriber then begins the session when the original caller responds.

[**0118**] When embodiment (ii) is used, the following details one embodiment for initiating a new, modified session to the subscriber (by the caller). While the calling cellular phone continues its connection attempt, the Service Platform **435** sends an alphanumeric or Short Message Service (SMS) message to the caller with the number of the cellular phone **307**. In one aspect of this embodiment, the calling cellular phone terminates the calling attempt and initiates a separate call to the cellular phone **307**. Alternatively, the phone number of cellular phone **307** is hidden from the user of the calling cellular phone, and the entire hang-up-redial transaction occurs under the control of a program residing in the caller's cell-phone.

[**0119**] STEP **1026**: Service Platform **435** ignores the incoming call attempt by not alerting any subscriber device that the call is being attempted. This is a distinct option from STEP **1028**.

[**0120**] STEP **1028**: When dictated by preferences stored in the Subscriber PPP database **450**, the Service Platform **435** redirects the call to the Messaging Platform **465**, which permits the caller's message to be recorded for subsequent subscriber access. Messaging Platform **465** may be a part of the Service Platform **435** or separate from it as shown in FIG. **4**.

[**0121**] Case 4: International Use.

[**0122**] One of the features of the MTAC Cradle **305** is its portability. When a VoIP MTA is plugged into an appropriate IP network anywhere around the world, it registers its new IP address with the service provider's registrar (e.g., a SIP registrar) and call redirectors (e.g., SIP Proxies) ensure that incoming calls to the subscriber's address (e.g., SIP Address) follow the subscriber via the IP network. When the MTAC Cradle **305** is moved to a different geographic area and plugged into an appropriate network there, the geographical presence is recorded in the Subscriber PPP database **450** as a result of the original handshake that enables the MTAC to register as "available for service". The set of rules applying in international situations are different, especially because of differences in session transport costs and in the cellular environments.

[**0123**] The subscriber's service provider establishes relationships with other service providers around the world. These relationships enable global coverage and uniformity in service behavior from the viewpoint of the subscriber, and establish geographic associations between the subscriber's location, the relevant service providers and the relevant preferences/rule-base applying when operating from that environment.

[**0124**] Nationally and internationally, local service providers with whom agreements are desired include broadband access providers and cellular carriers or resellers. Business agreements may be formed bilaterally or through a centralized service Federation or Clearinghouse (covered in Case 5 below). The business agreements are the source of much of the data that populates the Service Providers database **455**, the Payments Clearing database **445**, and the Geographic Association database **460**. Service-provider provisioning & de-provisioning processes include system security and financial safeguards known in the art. For example, authenticated services administrators and systems with specific roles are permitted to populate and/or modify specific portions of the databases **440**, **445**, **455** and **460**, whereas other service participants and systems are merely allowed to read portions of the data. Subscribers to the service obtain secure authentication means upon service provisioning for permitting access to corresponding portions of the Subscriber PPP database **450** to populate and alter their profile and preferences data. The systems protect against other access, data contamination, or denial-of-service attacks by known means that are outside the scope of this invention.

[**0125**] The term carrier is used interchangeably with cellular service provider, cellular service reseller, Mobile Virtual Network Operator, or others who provide the same relevant services.

[0126] The cellular phone **307** that is used by a subscriber who travels abroad may be the same cellular phone **307** the subscriber uses in the home country if the cellular phone enables international use. For example, a model that currently enables international use is the GSM World Phone that enables international use through participating cellular carriers as long as the SIM card embedded in the cellular phone is preprogrammed, replaced or reprogrammed to operate in the region of travel.

[0127] FIG. **7** describes an exemplary MTAC Cradle **305** and Cellular-phone **307** international registration process that extends the service internationally.

[0128] STEP **700**: When an MTAC Cradle **305** with a connected cellular phone **307** is plugged into an outlet of a broadband network, such as the IP Network **115** of FIG. **3**, or otherwise establishes signaling and data connection with the IP Network **115**, the MTAC Cradle **305** obtains an IP address from a local Internet Service Provider (ISP). The broadband ISP may be participating as a service provider of Service Providers database **455** or non-participating, for example as obtained by the subscriber aboard.

[0129] When a VoIP MTA is plugged into an appropriate IP network anywhere around the world, it registers its new IP address with the service provider's registrar (e.g., a SIP registrar) and call redirectors (e.g., SIP Proxies) ensure that incoming calls to the subscriber's address (e.g., SIP Address or PSTN phone number) follow the subscriber via the IP network.

[0130] STEP **701**: The MTAC Cradle **305** provides information to be registered with its SIP Proxy **425**. That is, there is a registration of the MTAC Cradle **305** with its SIP Proxy **425**. This registration follows known and evolving SIP and follow-on standards.

[0131] STEP **702**: The Service Platform **435** is alerted to record changes in the presence of the MTAC Cradle **305** in the Subscriber PPP database **450**; that is, the new geographical presence is recorded in the Subscriber PPP database **450** as a result of the original handshake that enables the MTAC Cradle **305** to register as "available for service". The geopolitical region in which the MTAC Cradle **305** resides is established through an association of the IP address assigned to the Cradle with its expected geography. The Service Platform **435** uses the Geographic Association database **460** to adjust geography dependent presence conditions in the Subscriber PPP database **450** to reflect the new geographic location of the MTAC Cradle **305**, so that the appropriate set or sets of rules may be applied to the new geographic location.

[0132] When service providers are registered to provide internet services described in this disclosure, appropriate entries are made to Service Providers **455**, and to the Geographic Association database **460** by service administrators and participating service providers. This enables subsequent association between subscriber location and the service provider(s) with whom an agreement to supply a subscribed service in that geographic area exists. For example, a participating provider of Cellular Network **110**, which tracks the location of and communicates with cellular phone **307**, defines an approximate geographic location at the required degrees of granularity, the identity of the service provider usually provides at least a national geographic boundary within which the cellular phone **307** is present. The identity of the cell-site or cell sector in communication with the cellular phone **307** further refines the geographic location of the cellular phone **307** as needed. Other cellular phone location techniques (e.g., triangulation among multiple cell sites) permit the cellular carrier to improve the precision of the location of the cellular phone **307**. A very precise location could be establish for cellular phones **307** that incorporate GPS receivers. The GPS receivers have the following additional advantages: (i) precise location can be established independently of the cellular carrier, and (ii) this precision may be sufficient to forego the need for placing the cellular phone **307** in MTAC Cradle **305** for the subset of the services that rely on the collocation (but not necessarily the connection) of the MTAC Cradle **305** and Cellular phone **307**.

[0133] STEP **703**: The Service Platform **435** then associates the Service Providers database **455** with the derived geography in the Geographic Association database **460** from step **702**, to pick one or more participating cellular carriers active at the new geographic location listed in "presence" in the Subscriber PPP database **450** as updated in step **702**.

[0134] STEP **704**: After the MTAC Cradle **305** identifies the cellular phone **307** connected to the MTAC Cradle **305**, the MTAC Cradle **305** sends through the IP network **115** to Service Platform **435** the identity and capabilities of the cellular phone **307**. Alternatively, the unique number associated with the cell phone may be transmitted through the MTAC cradle, followed by the Service Platform or its agent performing equipment lookup in an authorized-cellphone database (not shown in FIG. **4**) established and maintained for the purpose of this service. In the trivial case, the cellular phone is the one used by the subscriber at the home-base, and its capabilities are known. International standards such as IMEI (International Mobile Equipment Identity) define the aforementioned unique number.

[0135] STEP **705**: The Service Platform **435** determines if the type of cellular phone **307** is compatible with a local cellular carrier registered in database **455** for that geographic region.

[0136] When subscribers use internationally capable cellphones such as the GSM World phone, it is possible to adapt the subscriber's original cellular phone to local conditions by modifying the SIM card or installing a new SIM card available from local cellular carriers around the world.

[0137] STEP **706**: When there is a match in step **705**, the Service Platform **435** begins a process designed to program the SIM card of the cellular phone **307** to match local conditions, followed by a test cellular call to/from the connected cellular phone **307** to some test number. The process of programming the SIM card includes three alternative embodiments; (i) obtaining a substitute SIM card from a local participating cellular service provider and inserting it in the cellphone **307**; (ii) using the Service Platform **435** to program the SIM card (via IP Network **115**) that is within the cellphone connected to the MTAC cradle **305**; (iii) giving a local participating cellular service provider access (via IP network **115**) to the MTAC cradle **305** for the purpose of programming the SIM card that is within the cellphone connected to it. Alternate embodiments (ii) and (iii) require the inclusion of SIM-programming features. For example, the MTAC Cradle Plus ("Plus" designation

refers to the SIM-programming capabilities) will enable the programming of the SIM card to occur in a manner similar to that used by SIM card programming devices today. Since SIM-card programming must be performed under secure conditions to avoid spoofing and fraud, the MTAC Cradle Plus is ideally suited, being able to provide two separate, coordinated, potentially encrypted communications channels (cellular and IP) to the same cellphone **307** device. The illustrated embodiment covers the programming of the SIM card when it is installed in cellphone **307**, or when it is removed from the phone and placed in a special slot-connector that may be optionally provided for this purpose in the MTAC Cradle Plus.

[**0138**] STEP **707**: When the test call is successful, as confirmed by the MTAC Cradle **305**, the Service Platform **435**, the process proceeds to step **708**. When the test call fails, the process proceeds to step **709**.

[**0139**] STEP **708**: The Service Platform **435** will enter the new cellular phone number into the Subscriber PPP database **450** and inform the subscriber via the MTAC Cradle **305**, the cellular phone, or a text message (e.g., SMS). Exemplary notifications include: (i) the inclusion of a small display device on the MTAC Cradle **305** (or using the cradle/SIP Phone display if the MTA is integrated), (ii) the use of the cell-phone's display to convey such messages, or (iii) through voice messages called into the plain phone connected to the MTAC Cradle **305**. The Service Platform **435** also updates other platforms and databases to ensure the continued smooth operation of the disclosed service from the new location.

[**0140**] STEP **709**: If the SIM programming is unsuccessful for a specific cellular service provider or carrier serving that area, the next such cellular service provider (matching the general characteristic of the cellular phone that sits in the cradle, as was determined in step **704**) will be attempted after STEP **710** is performed.

[**0141**] STEP **710**: The Service Platform **435** determines if a next cellular service provider was obtained in step **709** and if so, processing returns to step **706**; if no next cellular service provider was obtained in step **709**, then all potential providers have been exhausted, and processing moves to step **711**.

[**0142**] STEP **711**: Once all available compatible local cellular carriers are exhausted, the Service Platform identifies alternative methods for obtaining a compatible cellular service, and conveys the information to the subscriber via the MTAC Cradle **305**. The geographic association **460** correlates the locations of facilities that are nearest to the subscriber for inclusion in the message. The process ends here, until appropriate action is taken by the subscriber based on the information provided herein. The Service Platform **435** assumes that the subscriber has no compatible local cellular phone until a new one is found and tested as described in STEP **712**.

[**0143**] STEP **712**: If/when the subscriber obtains a compatible SIM card or a new (usually rented) cell-phone, the process resumes in step **705**.

[**0144**] To get to STEP **712**, the subscriber obtains service that is covered under the original subscriber agreement as described in Subscriber PPP database **450** and AAA Subscriber Accounts database **440**. However, it is possible that the subscriber obtains a new cellphone and/or cellular services from a non-participating service provider. In that case, the newly recruited local cellular carrier provides Service Platform **435** with all the required data so that the appropriate databases **440**, **445**, **450**, **455** and **460** can be populated and/or updated.

[**0145**] Case 4A: Portability and International Use.

[**0146**] The MTAC IP cradle can be used as a personal gateway when the cellular phone **305** is connected to cradle **305**. The term "connected" (as used throughout this specification) includes not only the literal meaning of "in the cradle" or "nestled" as in FIG. **5**A, but also that the cellular phone **307** is operatively in the vicinity of the MTAC or MTAC IP Cradle **305** for direct communication as in FIG. **5**B and FIG. **5**C.

[**0147**] In many cases, moving the MTAC Cradle **305** within US boundaries keeps it within the cellular service provider's network. Depending on the cellular service agreement, service at remote locations may be provided through roaming agreements, which sometimes are priced at a premium. These details are pre-provisioned in the Service Providers database **455** by service administrators. Normally, the linking of the locally-assigned IP address with the Geographic Association database **460** enables the service provider to select the appropriate charging plan for the use of the local cellular network **10**. In another aspect of this invention, the state of connectivity (e.g., "digital", "analog roaming") of cell phone **307** is provided to the Service Platform **435**, preferably through the MTAC Cradle **305** via the interface with the cradled cell phone **307**; this enables the Service Platform **435** to determine the true cost of each call based on local, real-time conditions. The state of connectivity is not constant; for example, it may be dependent upon instantaneous cellular-network load.

[**0148**] In areas where the subscriber's cellular phone **307** operates, the cellular network **110** used to access the cellular phone **307** can provide additional geographic information that can be used to verify the location provided through IP-address association. The Geographic Association database **460** cross references the association between the subscriber location based on the cellular service provider and the subscriber location provided based on the IP address, and confirms that an agreement to supply a subscribed services in that geographic area exists. As discussed above with respect to STEP **702**, the location of the cellular phone **307** can be tracked to an approximate geographic location to whatever degree of granularity is required.

[**0149**] Case 5: The MTAC Cradle **305** is adapted to be a gateway between the Cellular Network **110** (and optionally the PSTN network if connected thereto) and the IP Network **115**; when adapted in this manner, the cradle becomes an MTAC IPG (MTA Cellular IP Gateway) **1230**. The MTAC IPG Cradle **1230** of FIG. **12** is a personal, multimedia IP communications (e.g., VoIP) portable gateway, which can accompany the subscriber abroad and operate abroad or domestically according to the example process disclosed in the flowchart of FIG. **11**. The MTAC IPG Cradle **1230** can be connected to and support incoming and outgoing communications from the cellular or PSTN networks, so that the subscriber can use any local phone (plain phone **1210** or cellular phone **1220**) to communicate via the IP network **115** (e.g., using VoIP). Optionally, the MTAC IPG **1230** may also

be connected to the PSTN, providing a gateway capability between any two of the three networks.

[0150] FIG. **13** (discussed later) illustrates a known MTA IPG. An MTA IPG is equivalent to the MTAC IPG that does not include the functions of the cellular cradle or connectivity. A personal gateway accepts incoming calls for the purpose of routing them through a different network to the ultimate destination. To be a personal gateway, the MTA or MTAC Cradle includes gateway functionality, such as, the ability to collect a string of DTMF tones dialed after providing a dial tone to the calling phone, and perhaps a voice-response capability for ease-of-use and for security/caller authentication purposes.

[0151] The traveling subscriber sets up the MTAC IPG in the same manner described for the MTAC in Case **4**. More particularly, with respect to FIG. **7**, after broadband connection and obtaining an IP address, step **700**, the MTAC IPG is registered with the SIP Proxy **425** and the Service Platform **435** as before, (step **701**), and the MTAC IPG presence is recorded in Subscriber PPP database **450** with the appropriate geographic association in the Geographic Association database **460**, step **702**. The processing of the remaining steps of FIG. **7** is performed to reach step **708** where the cellular phone **307** is now operable with a local cellular service provider.

[0152] In order to use the MTAC IPG **1230**, the (e.g., internationally) traveling subscriber leaves the cellular phone connected to the cradle, in order to communicate internationally using any local phone. In one preferred embodiment, the subscriber uses a local phone (landline or cellular) to call the MTAC IPG-connected cellular phone, then communicates internationally over VoIP via the private gateway. The term "local" refers to call cost in that a local call is any call that would make the cost of calling the MTAC IPG viable.

[0153] FIG. **11** describes an example of the use of the MTAC IPG **1230** once the cell-phone is operational.

[0154] STEP **1101**: To differentiate between using the MTAC Cradle **305** in a normal mode or in a gateway mode (MTAC IPG Cradle **1230**), the subscriber switches manually, or alternatively, the mode change is triggered by the subscriber usage (e.g., through DTMF signaling), after the cellular phone goes off-hook while connected to the MTAC IPG Cradle **1230**.

[0155] STEP **1102**: The subscriber uses plain phone **1210** of FIG. **12** to dial the number of the locally active cellular phone **307** (a first dial string), which is connected to the MTAC IPG Cradle **1230**. The call passes locally through the PSTN **120** and Cellular Network **110** and is transmitted to the cellular phone **307**. Alternatively, the subscriber uses cellular phone **1220** to dial cellular phone **307** in order to access the MTAC IPG **1230**.

[0156] STEP **1103**: The MTAC IPG Cradle **1230** senses the incoming call to the cellular phone **307** by the signaling of FIG. **6**, and the MTAC IPG Cradle **1230** causes the cellular phone**307** to go off hook; voice prompting or other automatic communication is provided for a better subscriber experience and to involve the subscriber if desired.

[0157] STEP **1104**: The MTAC IPG Cradle **1230** authenticates the caller, and provides a 2nd dial tone. The caller (the subscriber or any person he authorizes) dials out to reach the desired party over the IP Network **115** through the MTAC IPG **1230**. The desired party may be for example at the VoIP phone **1240** in FIG. **12** that is located in another country, or at a plain telephone that is connected via a VoIP service provider's gateway **1250**. The signaling of FIG. **6** may be used when the subscriber dials the second number. It the preferred embodiment, the ANI of the calling phone is used at least as part of the authentication process. In this manner, the subscriber may use the MTAC IPG **1230** with a minimum of added effort.

[0158] STEP **1105**: The cellular phone is constructed to enable direct media flows with the cradle, in addition to signaling, as shown in FIG. **6**. The media flows may be voice as spoken into or received by the cellular phone **307**, and video, stills, or graphics as permitted by the cellular phone **307**. Media flow occurs through physical connections in the cradle or through short-range networks like Bluetooth, UWB or Infrared as in FIGS. **5**A, **5**B, **5**C. These media flows are already encoded/decoded by the cellular codec that is in the cellular phone **307**.

[0159] When, the cellular codec is also used in the IP Network **115**, then the MTAC IPG does not transcode the media stream between the cellular phone **307** and the MTAC IPG **305**, removing a significant source of QoS degradation. In that case, the MTAC IPG **305** still performs media packetizing depacketing and buffering, which are standard functions of media gateways.

[0160] When cellular CODECs become a standard part of VoIP options deployed at all VoIP phones and media gateways, then the cost of the MTAC IPG Cradle **305** is reduced.

[0161] STEP **1106**: At the end of the session, the MTAC IPG **1230** in cooperation with the Service Platform **435** update AAA subscriber database **440**. The subsequent transaction against the Payments Clearing database **445** may be executed in real time or in periodic batch runs.

[0162] The "local" call the subscriber makes to the MTAC IPG Cradle **1230** is preferably charged to the subscriber through local arrangements. As an option, most of such costs are registered in the AAA Subscriber Accounts database **440** by, for example: (i) including the local service carrier among the Service Providers in **455**, with pre-established billing arrangements, for example, the local call can look like a prepaid-card call, (ii) renting a separate cellular phone **307** from a participating service provider for this purpose, or (iii) combining the second arrangement (ii) with establishing the local call as a reverse-call through the use of such alerting techniques as text messaging in the cellular phone **307**.

[0163] As shown in FIG. **13**, an MTA IPG (i.e., one without a Cellular Cradle) **1330** includes two network connections, one to the broadband IP network **115**, and the other to the PSTN network **120**. The MTA IPG requires a standard array of Codecs. The MTA IPG operation is similar to that described for the MTAC Cradle IPG **1230**, except that the incoming "local" call comes in from the PSTN for the MTA IPG and not from a cellular network as described for the MTAC Cradle IPG **305**. Cellular phone **1220** and Plain Phone **1210** are used by the subscriber to make or receive calls via the MTA IPG **1330** in the local (e.g., foreign) environment. These phones and VoIP Phone **1240** also represent initiating and terminating devices for calls to/from the subscriber. Gateway **1250** may be one of SSG **430** gateways.

[0164] Large scale deployment of a MTA IPG constitutes a traditional VoIP gateway (such as **1250**). The providers of such services may be included as Service Providers in database **455**, enabling subscribers to forego the use of personal gateways in certain geographical areas. Accounting, clearing and subscriber billing relative to traditional VoIP gateways may be integrated with the accounting, clearing and subscriber billing using the databases **440**, **445**, **455** and **460** of FIG. **4**.

[0165] Where traditional VoIP gateways are used for subscribers of this disclosure, those versed in the art can appreciate the ability to route incoming calls to the traveling subscribers' POTS or cellular phone numbers registered in the Subscriber PPP database **450**.

[0166] In addition to all of the structure, functionality and operation of the MTAC IPG Cradle **1230** described herein, the MTAC IPG Cradle additionally includes, as a further enhancement, a built-in DSL modem, as shown in FIG. **14**. The DSL modem enables the MTAC IPG Cradle **1430** to be plugged into a single network connection, conveying both PSTN traffic and broadband traffic over the same DSL transmission link connector. In that case, the MTAC IPG **1430** may include connectivity to PSTN **120**, IP Network **115**, and Cellular Network **110**.

[0167] Case 6: International Service Federation.

[0168] The service of the present disclosure involves multiple service providers. The providers may be geographically exclusive or geographically competitive. The preservation of quality standards dictates the need for a single quality-control entity that filters potential service providers by quality of service and financial strength. The service providers may form a federation that co-manages the service of this disclosure.

[0169] Such federation arrangement may include self-provisioning capabilities that are supervised through the use of mandatory approval-role workflow arrangements. Provisioning will at least partially populate a plurality of databases: the Subscriber PPP database **440** having information specific to subscribers of the one number services, the Service Providers database **455** having details of service providers participating in integrated one number services available to the subscribers, the Payments Clearing database **445** specific accounting information and service pricing according to the legal agreement between the service provider and the federation, and the Geographic Association database **460** slotting the new provider to particular service-geography pairs.

[0170] As discussed earlier in this disclosure, private subscriber arrangements with service providers constitute a significant potential marketing force for the federation, since the registration of the subscriber's e.g., cellular phone and service in new geography may trigger the registration of the new service provider in the federation.

[0171] The International Service Federation coordinates the services and related accounting of a plurality of multi-national service providers that offer one number services for communication over one or more of IP, PSTN and cellular networks for satisfying subscriber communication needs.

QoS Improvement

[0172] Where a cellular call is conventionally routed via an IP Network, a significant degradation of the quality of service (QoS) normally ensues due to the use of at least two media gateway operations. In one media-gateway operation, the cell phone **307** compresses voice into a format suitable for the cellular medium, for example by using GSM or Code Division Multiple Access (CDMA) codecs. A codec is a coder/decoder, which is usually found as an element of a gateway, MTA, VoIP phone, or software program that compresses and decompresses media, for example voice or video media. Video or still picture formats are used in some cellular phones. In the second media-gateway operation, a VoIP gateway that is a part of Gateways **430** transcodes the media to a format suitable for transmission over an IP network. Transcoding modifies the stream of data so that it may be carried via a different type of network and by way of example may involve one of the series of suggested standards covering transmission facilities in different networks, namely standards G.711, G.713.1 and G.729A, which are ITU-T standard voice Codecs.

[0173] To avoid unnecessary degradation in QoS, cellular codecs may be used at gateways of the IP network during call session initiation. For example, the Service Platform **435** uses one of the SIP Proxies **425** to force (via SIP signaling) a match between the cellular telephone's **307** codec and the codec used at the gateway to the IP network **115**. Thereby, transcoding is avoided from the cradled cellular phone **307** to the IP network **115**. There is still a need for packetizing and/or depacketizing at transition points between networks, but adding or selecting of a codec at session initiation according to the illustrated embodiment eliminates the need for some or all transcoding. Therefore, the QoS of cellular voice traversing IP networks increases commensurately with the elimination of transcoding. This matching of Codecs simplifies the design of the MTAC cradle **305**, since the MTAC cradle **305** needs to operate as a gateway to the IP Network **115**, and/or as a gateway between the plain telephone **103** to the cellular phone **307**.

[0174] FIG. **17** provides additional details of such QoS improvements. FIG. **17** illustrates the elimination of QoS-reducing transcoding stages that occurs when IP codecs (e.g., VoIP codecs) are identical to cellular codecs. This requires cellular codecs to be among those present in transcoding gateways, VoIP phones **1730**, and other digital devices such as computers running VoIP programs.

[0175] Non-transcoding gateways **1720** provide buffering and packetizing/depacketizing functions, but they need not employ a media codec, and hence reduce the degradation in the quality of the media. SIP signaling, for example, permits for negotiating the best codec present in end-devices and gateways.

[0176] Cellular gateways **1740** transcode the media from cellular-media encoding to PSTN voice encoding (e.g., A-Law, Mu-Law). For the purpose of simplicity, cellular gateways **1740** are shown as a function that is allocated to the MSC **1710**. In reality, the functions are distributed between the MSC and Base Transceiver Station (BTS, not shown); BTS is associated with the air (radio) interface at or near cellular antenna locations. Also for the sake of simplicity, signaling gateways are not shown.

[0177] MTAC Cradle **305** may use the codec already embedded in cellular phone **307** to encode/decode content

destined for transmission through IP Networks **110**. This may require certain changes to the way functionality and interfaces are structured in cellular handsets. Alternatively, the cradle may contain cellular codecs, which, under the control of Service Platform **435** reduces the number of end-to-end transcoding stages in each session.

[**0178**] In a preferred embodiment, non-transcoding VoIP gateways **1720** also constitute SIP proxies which negotiate codecs with other media gateways (e.g., VoIP gateway **1750**) or with SIP endpoints such as "VoIP Device with cellular codec"**1730** and MTAC Cradle **305**. This negotiation determines whether transcoding can be eliminated for specific network legs on a session-by-session basis, and may eliminate transcoding end-to-end for at least a subset of such sessions.

[**0179**] In an exemplary application, plain phone **103** wishes to dial a cellular user through a VoIP service. The phone dials a VoIP gateway assigned by a VoIP service provider. The gateway identifies the terminating number as cellular, verifies that non-transcoding service is available to that termination, then negotiates the appropriate cellular codec with a non-transcoding VoIP gateway associated with the terminating side, and initiates the session. In known systems, cellular access networks are connected via PSTN, and multiple transcodings normally occur. Some of that is disappearing in 3G networks, but the connection to SIP endpoints and plain phones is not a part of 3G.

[**0180**] MTAC Cradle **305** may be designed to use the cellular codec already embedded in cellular phone **307**. However, this requires the separation of functions (codec from air interface) in the cellular phone, and exposing appropriate physical and logical interfaces in the cellular phone **307** for communicating with MTAC Cradle **305**.

Daisy Chaining

[**0181**] In yet another alternate embodiment, the cradles **305**, connected to an IP network **115**, may be daisy-chained together. In one such embodiment, a first cradle **305** is left at a primary location (e.g., a user's residence) while a second cradle **305** is carried with the user. The user connects the second cradle **305** to the IP network **115** at a different location (e.g., in a foreign country), and instructs the second cradle **305** to authenticate itself to the first cradle **305**. Communications may then be sent from the second cradle to the first cradle (and vice versa) using IP communications, but seemingly as if the user were using a telephone connected to the first cradle directly. Such an embodiment may be beneficial in situations where the provider of the voice services will only permit a single unit per subscription fee. Moreover, in such a configuration, the ringing associated with an incoming call can occur at telephones connected to both the first and second cradles **305**. When coupled with distinctive ring tones or caller ID, the person on travel can identify which calls are for her/him, and the people still at the primary location can identify which calls are for them. When the telephone connected to the second cradle answers the phone, all communications are forwarded from the first cradle to the second cradle via IP communications.

[**0182**] While specific hardware has been disclosed by way of example and according to the best mode, other implementations are possible. For example, most of the functionality of the disclosed devices can be emulated by using a computer, e.g. a PC, with appropriate interfaces, applications and other software written according to the disclosed steps of operation. The broadband connection could be provided wirelessly (e.g., using the 802.11 or 802.16 standard). In this regard, the MTAC Cradles **305** should include broadband wireless capabilities supplanting or supplementing the other broadband connections disclosed.

[**0183**] Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

1-13. (canceled)

14. A multimedia communications method employing a portable multimedia terminal adapter cellular internet protocol gateway (MTAC IPG), between a cellular network and an IP network, comprising:

registering the MTAC IPG with a SIP Proxy;

providing a signaling-and-media-operative connection for a cellular phone that is in separate communication with a cellular network;

in response to a user locally dialing a first dial string that is the number of the cellular phone, signaling the cellular phone to go off-hook;

authenticating the user as an authorized user and thereafter dialing out over the IP network using a second dial string through the cellular phone;

providing gateway functionality between the cellular phone connection and the IP network;

transmitting cellular phone media flows encoded by a cellular phone codec to the IP network; and

packetizing/depacketizing and buffering the media flows as the media flows flow between the cellular and IP networks.

15. The method of claim 14, wherein the step of transmitting comprises transmitting the media flows encoded by the cellular phone codec to pass to the IP network without further coding.

16. The method of claim 15, further comprising disabling any codecs residing in the MTAC/IPG.

17. The method of claim 16, wherein said disabling further includes switching from an MTA IPG mode having an array of codecs, and only broadband IP and PSTN operative connections to an MTAC IPG mode having cellular and broadband IP connections; and

performing IPG operations for the MTA IPG mode the same as performing IPG operations for the MTAC IPG mode, except that said signaling is in response to the user locally dialing the first dial string in from the PSTN for the MTA IPG mode and from a cellular network for the MTAC IPG mode.

18. The method of claim 17, wherein said switching is triggered by signaling indicating a user dialing to the PSTN and the cellular phone being off-hook, respectively.

19. The method of claim 14, further comprising recording MTAC IPG presence information in a database with a geographic association to the current geographical location of the MTAC IPG.

20. The method of claim 14, wherein said authenticating occurs when calls coming into the gateway are from a specific cellular phone or landline and the ANI of the calling phone is used at least as part of the authentication.

21. The method of claim 14, wherein providing said gateway functionality comprises collecting a string of DTMF tones dialed after providing a dial tone to a calling phone.

22. The method of claim 14, further comprising setting up a broadband connection and obtaining an IP address.

23-29. (canceled)

30. A method of transcoding reduction in communicating over an IP network, comprising:

identifying coding capability of a cellular device connected to the IP network; and

signaling setup of a communication session between the cellular device and the IP network with peripheral gateways closest to the cellular device to be selected for compatibility with the cellular device coding capability.

31. The method of claim 30, further comprising:

exchanging communication session media only as encoded by the cellular device without further transcoding between the cellular device and the IP network.

32. The method of claim 31, wherein the steps are performed by a VoIP device.

33. The method of claim 31, wherein the steps are performed by a portable gateway that is not a component of the IP network.

34. The method of claim 31, wherein the steps are performed by a portable, multimedia terminal adapter (MTA).

35. The method of claim 31, wherein said exchanging is free of cellular network transmission.

36. The method of claim 35, wherein the steps are performed by a VoIP device.

37. The method of claim 35, wherein the steps are performed by a portable gateway that is not a component of the IP network.

38. The method of claim 35, wherein the steps are performed by a portable, multimedia terminal adapter (MTA).

39. The method of claim 30, wherein the steps are performed by a VoIP device.

40. The method of claim 30, wherein the steps are performed by a portable gateway that is not a component of the IP network.

41. The method of claim 30, wherein the steps are performed by a portable, multimedia terminal adapter (MTA).

42-68. (canceled)

69. A method of registering a multimedia terminal adapter/cellular internet protocol gateway (MTAC IPG), having a cradle, at a new location, comprising:

in response to the MTAC IPG establishing signaling and media connection with an IP network, obtaining an IP address from a local internet service provider;

recording geographical presence of the MTAC IPG in a geographic association database;

adjusting geography dependent presence conditions in the geographic association database to reflect a new geographic location of the MTAC cradle;

selecting an appropriate set of rules for the new geographic location;

associating a service providers database with the derived geography in the geographic association database and selecting at least one participating cellular carrier at the new presence geographic location;

receiving an identity and capabilities of the cellular phone;

determining a cellular carrier in the geographic region that is compatible with the capabilities of cellular phone;

programing the SIM card of the cellular phone in accordance with the results of said determining;

triggering a test cellular call between the cellular phone and a test number;

reprogramming the SIM card in response to the test call results;

recording the new local cellular phone number.

70. The method of claim 69, further comprising reversing a call direction when the cellular phone is operatively connected to the MTAC IPG in response to a caller hang up.

71. The method of claim 70, further comprising: in response to a signaling indicating that the caller hung up, signaling the cellular phone to go off hook and dial a number of the caller; and ringing another phone that is short range connected to the MTAC IPG for alerting the originally called party.

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